November, 1966

computers and automation

6

Drill by Computer in Geometry

It only takes a split second to access mortgage records at First Federal Savings and Loan Association of Miami.

Bell System Data-Phone* service is the vital link.

All of First Federal's 96,000 savings accounts at seven branches are "on line" with the association's central computer. A debit, credit or inquiry made at a teller's window can be handled in 5 to 10 seconds —complete with printout.

This real-time, input/output operation is performed on business machines connected to Data-Phone data sets and to the computer via telephone lines. The operation is simply to enter the account number and type of transaction. The computer answers immediately.

Mortgage records are stored on magnetic cards, 112 records to a card, and any single record can be accessed at random.

To trial-balance the entire mortgage portfolio takes just 17 minutes. (It used to take days.)

So fast is the new system, that First Federal has computer time for automating other operations.

When you think of data communications, think of us.

*Service mark of the Bell System

AT&T Bell System
American Telephone & Telegraph and Associated Companies

Tape is not tape

When it comes to wrapping a package or patching a cut or recording a symphony there is usually one brand of tape that does the job a little better than anything else . . . but people being what they are, not everyone uses it.

Likewise, in critical data processing applications, there is one precision tape that stands above the rest in terms of value . . . but not everyone uses Computape either.

There are still tape users who have not discovered that, if they buy Computape, they get far more than a certified reel of reliable, quality recording tape. They still haven't found that the tape itself is only half the story . . . that unlike many other tape manufacturers, *Computron follows through.*

Those who *do* use Computape, of course, are familiar, not only with the quick delivery, the fine performance, and the convenience features, but also with extras such as Computron's unique applications engineering service — available without charge, on short notice, in all parts of the country.

Perhaps you should be using Computape. Find out. Write today for the complete story.

COMPUTRON INC

122 CALVARY STREET, WALTHAM, MASSACHUSETTS 02154

Designate No. 4 on Readers Service Card

In the Computer-Assisted Instruction Center of Florida State University, Wendy Holladay, fifth grade, considers a geometry question. When she responded "yes," the computer typed "correct" and presented the next question.

computers and automation

NOVEMBER, 1966 Vol. 15, No. 11

In This Issue

Special Feature: Small Computers

In Every Issue

COMPUTERS AND AUTOMATION IS PUBLISHED MONTHLY AT 815 WASHINGTON ST., NEWTONVILLE, MASS. 02160, BY BERKELEY ENTERPRISES, INC. PRINTED IN U.S.A. SUBSCRIPTION RATES: UNITED STATES, $15.00 FOR 1 YEAR, $29.00 FOR 2 YEARS, INCLUDING THE JUNE DIRECTORY ISSUE; CANADA, ADD 50c A YEAR FOR POSTAGE; FOREIGN, ADD $3.50 A YEAR FOR POSTAGE. ADDRESS ALL EDITORIAL AND SUBSCRIPTION MAIL TO BERKELEY ENTERPRISES, INC., 815 WASHINGTON ST., NEWTONVILLE, MASS., 02160. SECOND CLASS POSTAGE PAID AT BOSTON, MASS.

POSTMASTER: PLEASE SEND ALL FORMS 3579 TO BERKELEY ENTERPRISES, INC., 815 WASHINGTON ST., NEWTONVILLE, MASS. 02160.

CHANGE OF ADDRESS: IF YOUR ADDRESS CHANGES, PLEASE SEND US BOTH YOUR NEW ADDRESS AND YOUR OLD ADDRESS (AS IT APPEARS ON THE MAGAZINE ADDRESS IMPRINT), AND ALLOW THREE WEEKS FOR THE CHANGE TO BE MADE.

Subscription Fulfillment

A recent "confidential" newsletter to advertising, marketing, and media executives contains the following paragraph:

> *Magazine Fulfillment Services Departments Outdated.* Publishers lack standardized paper-handling techniques. Years behind mail-order houses in mail opening, cash-handling. Many up to seven weeks behind in opening mail. . . . . Publishers bought early computer models. Found them ineffective for mail handling. [name] magazine improves operations without computer, uses mail-order techniques. [names] magazines need more efficient service. Could save 20% in unit cost of handling subscriptions.

In a panel discussion held at a meeting of the Subscription Fulfillment Managers' Association, one panel member said the following:

> . . . I am assigned to talk about complaints. . . . There's nothing new about complaints; no matter what you do, you're going to have them. If you're one hundred percent pure, somebody is going to complain because you're so good, you know. . . .
>
> What do you do when a subscriber doesn't remember he ordered a magazine; he sent you an order to bill him, and you bill him. What do you do?
>
> What do you do when he tells you this is his third request to change his address and you know darn well this is the first time you ever heard from him? What do you tell him? . . .
>
> What do you do when the letter says, "Please stop billing my husband; he left and took all the money. P.S. If you find him, let me know." . . .
>
> What do you do when . . .

This year "Computers and Automation" passed the mark of 10,000 paid subscribers. So we now have more subscriber complaints than we have ever had, even supposing that the percentage is just the same. We try very hard to mail our magazine promptly to our subscribers each month; and it takes a lot of people on their toes to do it right. Even though we use a computer, and have our file of subscribers on magnetic tape, some mistakes are made.

Our subscribers are filed in geographic order, because the magazine has to be mailed twelve times a year in packages classified geographically, and the post office has to deliver them geographically. An alphabetic cross-index of subscribers — to be maintained for all changes of address and period of subscription — is totally impractical. So it is almost impossible for us to find a subscriber unless we have his geographic address. So, in the case of a notice of address change, if we do not have the old address, we can't act, and we have to write for more information. Delay. Expense. Dissatisfaction.

Another source of trouble is the difference between the "sold to" and the "shipped to" address. "Sold to" is jargon for the person or organization paying for the subscription. "Shipped to" is jargon for the person receiving the subscription. Suppose Mr. John Jones, writing from Arlington, New Jersey, orders a subscription from us and says "my company will send you the payment for my subscription, which is to be sent to my home." Three weeks later Giant Production Corporation, New York, N.Y., sends us a check for $15.00 for "subscription for Mr. John Jones, Assistant EDP Manager, to be sent to his home address, as ordered." What do you do? How do you match it? All we can do is write the company and ask them to tell us what is the address to which Mr. John Jones' subscription should be sent. In the meantime copies have started going to Mr. Jones, with a bill to him, and like as not, he winds up incorrectly with two subscriptions, one paid, one on credit, and no matching. Delay. Expense. Dissatisfaction.

As I write this editorial, I have in front of me a voucher which came off a check. The date is typed "JUN 20, 66." The "account number" is typed "103986," a number which does not agree with any invoice number we have. The "invoice amount" is typed $4.00. The "remarks" are typed [sic]:

subscription to computers & automation, November, 1966

At the bottom of the voucher, printed, is "C of P 14." On the voucher there is no name of a bank, nor name of an organization, nor name of a subscriber, nor any address. What do you do? We have no way of crediting this $4 to anybody. We have no way of inquiring of anybody whose $4 this is. (It is beyond my understanding how any modern organization could use printed vouchers for its checks that do not bear any name or address!)

Also, I have in front of me a torn portion of a renewal bill showing a name "G. W. Nash" [name changed] and part of an address "509 Wesley R" (the R might be the first part of "Road" or "Route"). It is stamped "paid $7.50"; it was received October 1965. It came out of a folder "circulation puzzles" that our fulfillment service keeps. Last week, a letter arrived from Mr. Nash's lawyer demanding his money back, because he had received no magazine for a year. Even that letter did not tell Mr. Nash's address, but it gave us a clue and we located Mr. Nash's address in Springfield, Delaware Co., Pennsylvania. So we wrote Mr. Nash, returned his money, and told him we were sending him a 6-month free subscription to try to make amends. How did his renewal bill get torn, and the other portion disappear? Probably, clerical error in our office. But how correct it? There was literally nothing we could do — the geographical file is not accessible alphabetically — until we received more information.

No computer in the world can yet produce appropriate input information for subscription fulfillment from observations of the real world. It takes human beings to do that, to find out the names and addresses of persons and organizations, and to put down the results of human transactions in a form to go into a computer.

The policy of our magazine is to do the best we can to deliver our magazine to our subscribers, and where any error has happened, we try to make good to the best of our ability. And we ask our subscribers to please tell us the crucial information in the first letter they write, so that we can have: no delay — the least expense — and the most satisfaction.

Edmund C. Berkeley

EDITOR

MULTI-ACCESS FORUM

FREE DISSEMINATION OF COMPUTER PROGRAMS FROM NASA

Donald F. Kennedy, Director
Computer Software Management and Information Center (COSMIC)
The University of Georgia, Computer Center
Athens, Georgia 30601
Telephone: (404) 542-3265

The University of Georgia has been awarded a contract by the Marshall Space Flight Center to establish and operate a Computer Software Management and Information Center (COSMIC) as part of the NASA Technology Utilization Program. The Technology Utilization Program was formed under the provisions of the Space Act of 1958 which required NASA to provide for the widest appropriate dissemination of information concerning its activities and the results thereof.

Through COSMIC, the National Aeronautics and Space Administration will make available to the nation a selected segment of computer programs representing an investment of millions of dollars. The selection of the well documented and operational computer programs for dissemination by COSMIC will be based on their potential usefulness and cost savings to other computation facilities. The Technology Utilization Office at each NASA Center will obtain computer programs for the COSMIC library from both in-house and contractor efforts. Programs developed or modified under NASA contract will be requested through the New Technology Clause placed in most NASA contracts.

Announcements of these selected programs will be made to the nation by NASA through various Technology Utilization media. In addition, the University of Georgia will form a COSMIC mailing list and make automated abstract announcements of new program arrivals to members of this mailing list.

Each requestor will be charged for the handling and mailing of computer programs. There will be no charge for copies of computer program documentation. Due to the organization and staffing plan of the COSMIC operation and maximum utilization of graduate and undergraduate students, the cost to the requestor will be a small fraction of the costs that would be experienced with commercial suppliers of computer software.

The computer programs (source decks) will be disseminated in tape or card form, depending upon the requestor's preference. However, it is recommended that program decks which are over 2000 cards be disseminated in tape form. *If a tape copy is requested, the requestor must furnish a copy tape for processing.*

An inventory listing of abstracts of available computer programs will be disseminated periodically. If you would like to have your name added to the mailing list or if you would like additional information, please contact this center.

SUPPRESSION OF INFORMATION IN THE MONTHLY COMPUTER CENSUS

I. From J. F. Sand

RCA Electronic Data Processing
Camden, N.J. 08101

Enclosed is the most recent information on RCA computer systems, expressed as average monthly rental figures. The up-dated average monthly rental figures are based on present customer contracts.

Please delete from the monthly census report figures on the number of installations and the number of unfilled orders. We cannot release this information at this time.

II. From the Editor

Thank you for your recent letter.

In the interests of our readers, we believe we should publish the number of installations and the number of unfilled orders. We do our best to estimate these figures. We are sorry you cannot confirm, deny, or improve these figures.

CZECHOSLOVAK COMPUTER REPORT

Paul F. Land
Director of Marketing Research
ECC
Poughkeepsie, N.Y. 12601

Czechoslovakia is expected to be in the market for 250 to 300 computers (and peripheral equipment) worth about $150-million in the next five years.

Czechoslovakia is considerably behind other industrial countries; the Czechoslovak government has decided to radically improve the situation. There is planned a 100% jump from 1965 to 1966 in the number of computers in use. There were only 26 digital computers in Czechoslovakia by the end of 1965. At least 26 new computers have to be installed by the end of 1966. But many computer users lack peripheral equipment. The problem will be solved mostly by import.

Twenty USSR-made MINSK 2/22 digital computers are to be delivered to Czechoslovakia during 1966. Some have been delivered with insufficient software, and the Czech importer, Kancelarske stroje n.p., therefore received 28% discount off the list price. Two automatic codes have been written for these computers in Czechoslovakia, by two teams of Prague programmers. The two autocodes are known as "Cyril Hucl's autocode" and "J. Formandl's MX A3 autocode." Czechoslovakia is experimenting with the digital computers in direct process control: the NCR 315 in a chemical factory; the ICT 1905 in a factory making heavy machinery; and the LEO 360 and the KDF 7 in two steel mills.

All of Eastern Europe wants more computers and special equipment to help with planning and industrial controls.

SYSTEMS ANALYSIS TRAINING — COMMENTS

I. From James C. Komar

Supervisor, Systems and Programming
Western Reserve Life Assurance Co. of Ohio
Cleveland 14, Ohio

If our staff were larger, we might be on the verge of panic after reading the article "Systems Analysis Training" in the September C&A Throughput column by Dick H. Brandon. This observation stems from the fact that Mr. Brandon is so very final in his dissemination of available systems training operations.

Mr. Brandon, a well known leader in this field, enumerates specific systems training ventures. This brings up a question: are there more or is he inferring that these are the best available?

I have recently made application for membership in the Systems and Procedures Association. Frankly, I would welcome Mr. Brandon's thoughts on the value of this organization, which fosters the exchange of systems experience and information among administrative executives and specialists in systems work.

One final thought — your publication, C&A, so far appears to be "fully packed." Keep it going!

II. From Dick H. Brandon

Brandon Applied Systems Inc.
New York, N.Y. 10017

I am glad to respond to your letter, perhaps to assuage the panic we have caused.

I am sorry to be negative, but for a $10-billion industry, whose very achievements depend on "good systems work," we have done abysmally little to enhance the "good" part.

Other efforts are gradually reaching the surface, but they are mild efforts at best. (For example, we have a client with an excellent systems training program, who is afraid to publicize it, for fear of exposing his staff to raiding.)

The SPA has in the past made no real effort in "computer systems," in my opinion, looking upon it more as the devil's work designed to destroy the stability of the systems and procedures profession. They also are beginning their efforts, but it is slow and unrewarding work.

FREE! THE COMPUTER HELPS YOU FIND YOUR NEW HOME FAST

The Boston Globe
Boston, Mass. 02101

(From an advertisement in the *Boston Globe,* August 3, 1966.)

> Exclusive with the Globe!
> "Find-a-Home Index"
> Here's How It Works:

You tell the computer just what you want by filling out the coupon below and mailing to our computer center. From the thousands of homes advertised by brokers and builders in the "Globe" in the last four weeks, the computer will list for you every house advertised that might fill your needs.

It will separate those ads in the specific geographical area and price range that you want. It will also show the style of home, number of baths and bedrooms advertised. The broker's or builder's name and telephone too will be shown; but your name is never given to any broker or builder; you are free to call as many or as few of them as you wish.

The point is this — if they have advertised what you are looking for in the "Boston Globe" this past month, we want to help you find them as fast and conveniently as possible.

Please check only one of each classification below:

AREA:
☐ Area 1 (North Shore) ☐ Area 9 (New Hampshire)
PRICE RANGE:
☐ Under $10,000 ☐ $40,000 and above
TYPE OF HOME: ☐ Ranch ☐ Cape ☐ Split-Level
☐ Multi-family ☐ Colonial ☐ Town House ☐ Duplex
☐ Contemporary
NO. OF BEDROOMS: ☐ 2 ☐ 3 ☐ 4 ☐ 5 or more
Name............... Address............... City............... Zip...............

RESEARCH ON MEANING IN PROGRAMMING LANGUAGES

Neil Macdonald
Assistant Editor
Computers and Automation

The article "System Analysis and Programming" by Christopher Strachey in the September, 1966, issue of "Scientific American" contains a very interesting proposition:

> Much of the theoretical work now being done in the field of programming languages is concerned with language syntax. In essence this means the research is concerned not with *what* the language says but with *how* it says it.
>
> This approach seems to put almost insuperable barriers in the way of forming new concepts — at least as far as language meaning is concerned. I believe the way to progress for programmers lies along the path of research on meaning rather than on syntax. It is through the study of meaning that we shall develop the concepts required to build up hierarchical structures.

The measure of success of any line of research is its success in answering questions and solving problems. When a path of research has been pursued for many man-years by brilliant men, and little fruit has been gathered, it is time to try new paths.

The ambiguity of syntax in:

> Time flies like an arrow.
> Fruit flies like a peach.
> Notice flies like a dragon-fly.

is resolved by considering meaning. This solution to ambiguity is common in everyday language. The ambiguity of 616000 where 600000 can mean JUMP TO and 16000 can mean a register, or 616000 can mean the number 616,000, is also resolved by considering meaning. The path of the study of meaning in programming is worth pursuing.

THE IMPORTANCE OF NOT TREATING A COMPUTER SYSTEM AS A PERSON

Anatol W. Holt
Applied Data Research, Inc.
Princeton, N.J.

(Based on a talk given at the evening session of the Special Interest Committee on Social Responsibilities of Computer People, at the National Meeting of the Association for Computing Machinery, Los Angeles, August 31, 1966)

In lay talk and in technical jargon about the functions of computing systems, a style of expression has evolved exemplified by:

- The computer program "reads" the text.
- The computer program "makes a mistake."
- The computer, a "teaching" machine (i.e., the computer "teaches").
- The computer "plays" a game.
- The program "answers" the question.

Phrases such as these reflect and promote the currently developing cultural habit of treating computer systems as *persons*. This entails an extension of the concept "person," similar to the historic extension of that same concept to cover corporations as well as individuals.

Now it is important to notice that actions by persons — individuals or corporations — imply *responsibility* by these persons. Persons are held responsible (by other persons) for what they do, ethically and legally. It is this, chiefly, which distinguishes action as attributed to persons from action as attributed to physical systems. If a man is killed by fish poisoning, the poison is held to *cause* his death but the fish store that sold it to him may be held *responsible*.

The functions of a computing system can be conceptualized in a way very different from the way implied by the five phrases above. *The system may be thought of as a medium through which messages can be passed between persons who constitute a communicating group.*

How does this view affect one's thinking about the role that computers might play? Let's consider two sample areas, teaching and payroll.

Computer Systems Used for Teaching

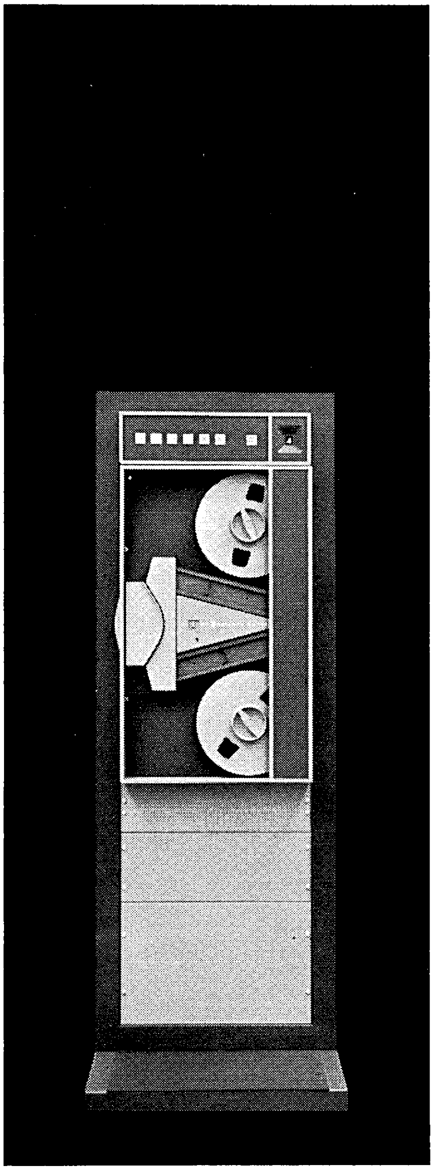
- A computer system may be used for teaching. The system is not a "teaching" machine, but a special medium through which teachers and students can communicate with one another. In this context such a medium can be very valuable because of several important properties:
- Messages from teachers to students can be amplified — i.e., one teacher's message can reach many students widely separated in space.
- More important, a message from a teacher can be variably delayed — i.e., need not reach all students at the same time. The time of delivery can depend upon an individual student's readiness to receive it, as signalled by messages from them to the teacher.
- A given message from a teacher can reach various students in different forms; its form for a given student can depend on messages which the student originated. For example, information broadcast to all students may reach a particular student in a form which depends on questions he recently addressed to the teacher via the computing machine.

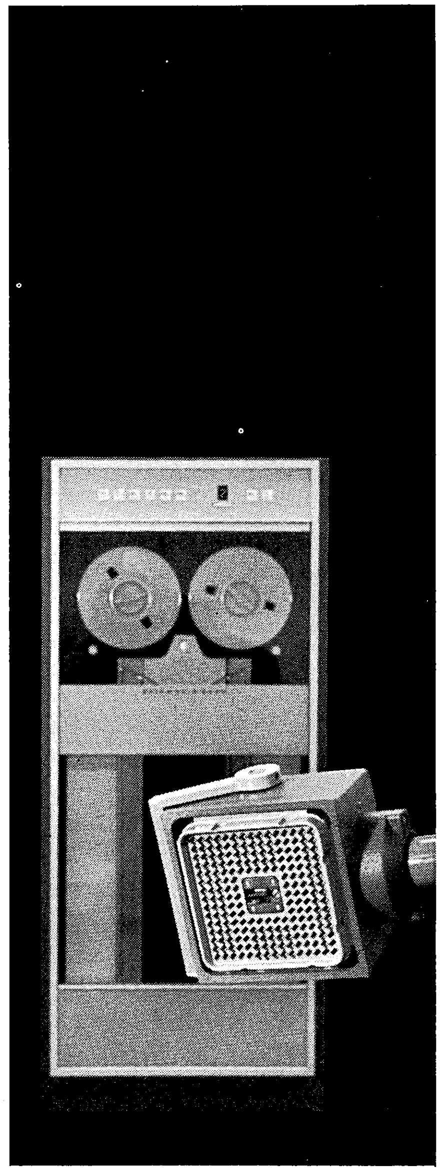
While this version of computer systems in teaching can be applied to current practice, it would motivate systems very differently designed from those now in use.

Anonymity

A key aspect of what has just been described is that the teacher is never permitted to fade into anonymity. A student has no reason to take his transactions at a computing console seriously, unless the teacher's "presence" is guaranteed: a teacher whose identity is known to the student, in whom the student places his trust, and whom the student may later blame, if he suffers any ill effects from the instruction which he receives.

computer peripherals that are more efficient, dependable, economical





for the computer manufacturer

The **D 2020** and **D 3030** computer magnetic tape units... standards of the industry in low cost/high reliability where moderate to medium speeds are required. Choice of 7-channel and 9-channel configurations, single units, master-slave systems, tape speeds from 1 inch per second to 75 inches per second.

for the computer user

The **D 3029** computer magnetic tape unit is plug-interchangeable with IBM 729 tape drives... field-proven reliability at low cost... rent or purchase.

To learn more about these profit-boosting computer peripherals and how they will fit into your scheme, write Tom Tracy at Datamec, 690 Middlefield Road, Mountain View, California 94041. Better yet, phone Tom at (415) 968-7291.

HEWLETT PACKARD **hp** *DATAMEC DIVISION*

Designate No. 6 on Readers Service Card

Messages Reaching the Teacher

There is a second aspect of student-teacher relations via a computing medium which is of great importance. The student must have confidence that his messages to the teacher, entered into the computing system, (a) will, under suitable conditions, reach the teacher; and (b) will not reach other persons — such as his social club, his employer, the Central Intelligence Agency, etc., for whom they were never intended.

Computer Systems Use for Meeting Payroll

A computer system may be used for meeting the payroll of a company. Here the primary function of the system is to transmit messages between employees and the accounting department. Again, it is not the system which computes a man's pay check but the accounting department. It is vital that that department remain in existence and that its identity be known to the employees; for, if a man receives a check which he deems wrong, it is that department that he wishes to argue with, not the computing system. Exactly as in the case of computing systems used for teaching, the employee must have effective guarantees that information which he submits, via the system to the accounting department does not reach other persons (agencies or individuals) without his knowledge and consent.

This discussion does not imply any deviation from current practice, but only illustrates the use of our point of view in the recognition of social changes.

Proper Accounting of Responsibility

Computing systems conceived of as communication media bring two classes of problems with social implications into sharp relief.

The first is *maintaining the proper accounting of responsibility for the effects of transactions which are computer assisted.* In John Steinbeck's "The Grapes of Wrath" the farmer whose home was about to be mowed down by a bulldozer threatened to shoot the driver. The driver said that shooting him would be futile; another driver would take his place; he was not responsible. After a long series of questions, each of which was answered by ". . . but he's not responsible either, he only works for . . ." the farmer finally exclaimed in despair: "Then who do I shoot?"

The second is *maintaining proper security in message delivery.* Persons who participate in actions mediated by computer systems must be guaranteed two basic kinds of knowledge: "From whom do these messages come to me?" and "To whom will these messages from me be delivered?" Personification of computers endangers both of these essential kinds of knowledge on which inter-person communication depends.

Personal Freedom

The conditions which support the historic novelty which we call "personal freedom" are indeed complex. They have to do with political and legal institutions as well as a host of widespread ethical attitudes which gave rise to these institutions in the first place, and which provide the motive power to maintain and adjust them in the face of world change. "1984" by George Orwell conjured up a dreadful and all too imaginable vision of how a world might become dehumanized. Still, that vision included a hierarchy of rulers in control of society. One could however conjure up a vision without rulers — i.e., a world in which giant technological systems use human beings as media of communication. In this direction Kafka's "The Castle" is more modern than "1984."

The issues being raised here become more and more pressing as:

- The number of computing systems increases.
- Their portability increases.
- The variety of peripheral equipment — sensors and effectors — increases.
- Involvement in biological processes increases.
- Inter-connectability increases.

Specific Steps

What are some specific steps which should be taken?

- A general awareness of the problems here discussed should be created by means of political, legal, technical, and literary publications and discussions.
- The computing profession should critically evaluate its technical jargon and related habits of conceptualization. The vocabulary for discussing the properties of computing systems as communication media hardly exists.
- Specific proposals should be formulated on what records must be maintained in computing systems to make answerable the questions "From whom do these messages come?" and "To whom can these messages go?" One must also consider what legal force should be exerted to assure the maintenance of such records.
- Many other legal questions should be examined; some of them have already been discussed in published articles dealing with the assignment of responsibility in events which are computer-influenced.

I suggest that consideration of the legal, political and technical issues raised here are, in part, the responsibility of the leaders in the computer field.

Note: The basic idea "computer as a medium" and its relation to the notion "responsibilty" is a contribution of C. A. Petri, University of Bonn.

JOURNAL OF COMPUTATIONAL PHYSICS — ANNOUNCEMENT

Academic Press
111 Fifth Ave.
New York, N.Y. 10003

The "Journal of Computational Physics" will commence publication in 1966 as a quarterly. Its editors are Berni J. Alder, Sidney Fernbach, and Manuel Rotenberg.

This new journal will be devoted to papers on the computational aspects of physical problems. It will emphasize the techniques involved in the numerical solution of mathematical equations and in automated data reduction rather than the physical significance of the solutions to these problems. The *"Journal of Computational Physics"* will be useful to all persons concerned with the numerical solution of problems in the physical sciences and with more effective use of computers. The associate editors are: Garrett Birkhoff, John M. Blatt, Keith A. Brueckner, Edward C. Bullard, J. M. Hammersley, Robert Jastrow, L. Kowarski, Peter D. Lax, Nicholas C. Metropolis, John Pasta, C. Pekeris, Emanuel R. Piore, Clemens C. J. Roothaan, Arthur H. Rosenfeld, Zevi Salzburg, Philip D. Thompson, George H. Vineyard, and M. H. Wrubel.

COMPUTER PERSONNEL RESEARCH GROUP — CALL FOR PAPERS

Charles D. Lothridge
General Electric Co.
570 Lexington Ave.
New York, N.Y. 10022

The Computer Personnel Research Group's Fifth Annual Conference will be held in Washington, D.C., in late June 1967. Papers concerned with research in the following major areas will be considered:

- Identification and selection of computer personnel with emphasis on development and validation of selection instruments
- Training and development of computer personnel with emphasis on new or revised techniques
- Current and anticipated changes in knowledge and skills needed by computer personnel
- Problems and skills involved in management of computer personnel

Authors are requested to submit a 300-word summary (problem, procedure, results, and conclusions) of their research to me by February 1, 1967. Authors will be notified of selection by March 1, 1967.

PROGRAMMERS' PROFESSIONAL SOCIETY

I. From John M. Calgani
East Orange, N.J. 07017

I have been programming for over a year now and am interested in joining a programmer's professional society. I would appreciate it very much if you could supply me with information as to what publication I might look at and/or the people I might write to, to find out about such societies.

II. From the Editor

The society which is perhaps closest to being a "programmers' professional society" is the Association for Computing Machinery. I would suggest that you write them for further information:

Association for Computing Machinery
211 East 43 St.
New York, N. Y. 10017

REMINDER:

"Certificate in Data Processing" Examinations Set for February 25, 1967, at 100 Test Centers in U.S. and Canada

R. Calvin Elliott
Data Processing Management Association
Park Ridge, Ill. 60068

The sixth annual examination for the "Certificate in Data Processing" (CDP) is to be given on February 25, 1967, at 100 test centers in the United States and Canada.

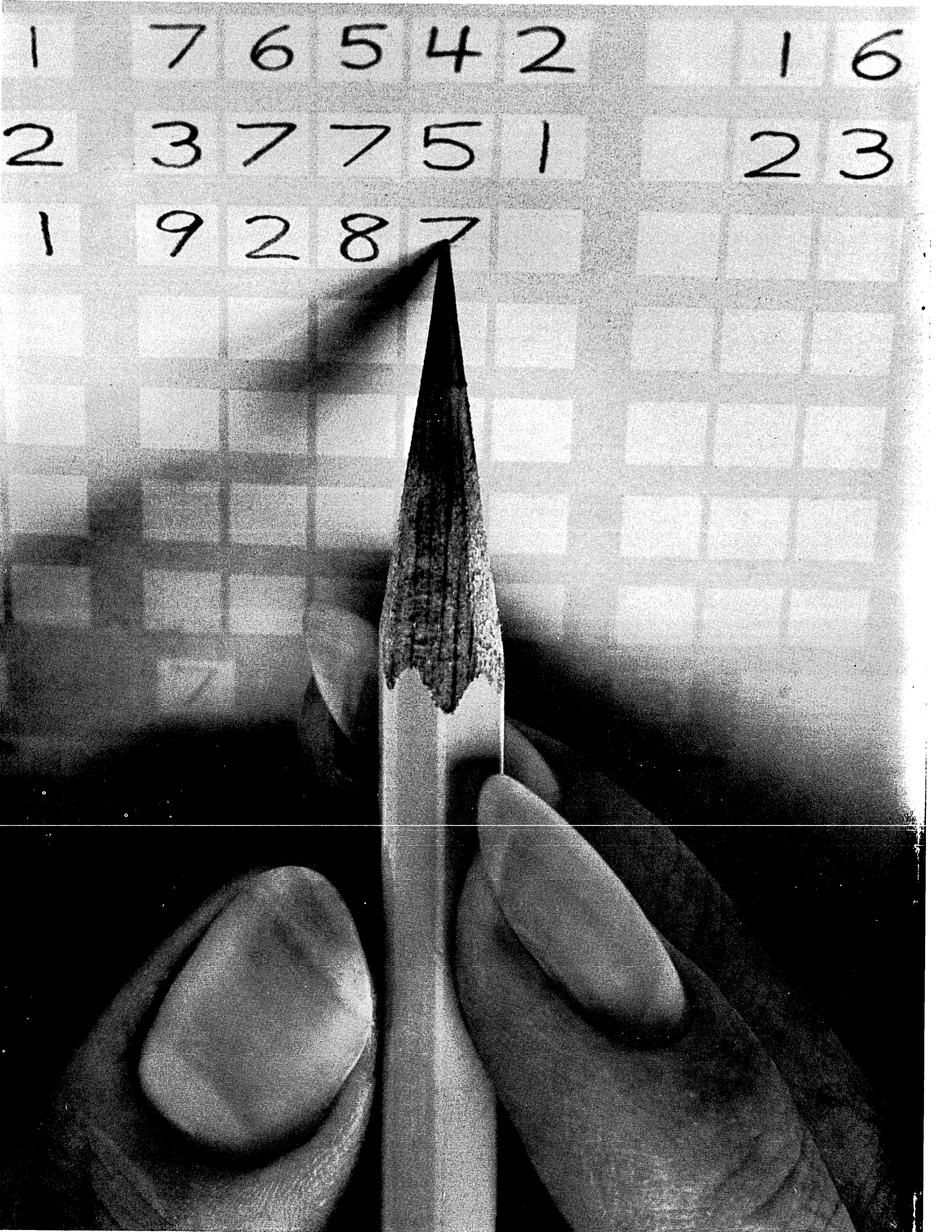
The three-hour examination is given at accredited colleges and universities and is designed to test a wide area of data processing knowledge considered necessary for professional competence in the field. Any person meeting the application requirements is eligible to sit for the examination; membership in DPMA is not a rquirement.

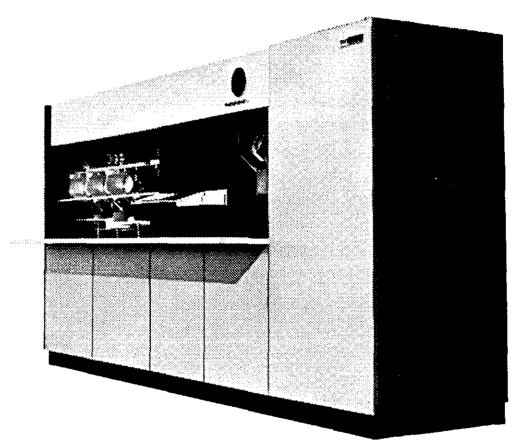
The examination consists of 220 multiple choice items covering: automatic data processing techniques and equipment; computer programming and software systems; data processing systems concepts, design and implementation; and quantitative methods in data processing including accounting, mathematics and statistics. Certification is granted to candidates who pass the comprehensive examination, meet a three-year experience requirement in data processing, and fulfill the academic requirements which include a number of college level courses encompassing the fields of business and mathematics.

Study Guides and application forms for the 1967 examination are available free from DPMA International Headquarters, 505 Busse Highway, Park Ridge, Illinois 60068. The deadline for filing applications is December 1, 1966. All applications must be submitted to DPMA headquarters.

There are two or more examination sites in: Alabama (3), Arizona, California (8), Florida (3), Illinois (3), Indiana, Iowa, Louisiana, Michigan, Missouri, New York (6), North Carolina, Ohio (4), Oklahoma, Pennsylvania, Tennessee (3), Texas (6), Virginia (3), Washington (3), Wisconsin; Alberta, Ontario (3), Quebec (3).

There are single sites in: Alaska, Arkansas, Colorado, Connecticut, District of Columbia, Georgia, Hawaii, Idaho, Kansas, Kentucky, Maine, Maryland, Massachusetts, Mississippi, Nebraska, Nevada, New Jersey, New Mexico, Oregon, Rhode Island, South Carolina, Utah, Vermont, West Virginia; British Columbia, Manitoba, Newfoundland, New Brunswick, Nova Scotia.


1 7 6 5 4 2 1 6
2 3 7 7 5 1 2 3
1 9 2 8 7



c&a MARKET REPORT

IBM HAD OVER 73% OF $8.2 BILLION U.S. COMPUTER MARKET AT END OF 1965; UNIVAC, CONTROL DATA HOLD PLACE, SHOW POSITIONS.

IBM's share of the total U. S. computer market declined just over a percentage point during 1965, dropping from 75% to 73.7% by year end. This is one of the findings of a study of the U. S. computer market recently completed by the International Data Corp., Newton, Mass., a leading computer market research firm. The study was based upon a statistical analysis of a Computer Installation Census File compiled during the past two years by I.D.C. This census file identifies on a current basis the users of nearly 85% of digital computer installations in the United States. The figures generated in the study have been extrapolated to cover the entire domestic market.

Univac held second place in the U. S. computer market with a 6.6% share at the end of '65, Control Data held third place with 4.5%, followed by Burroughs with 3.14% and Honeywell with 3.07%. RCA, General Electric, and NCR followed in that order.

The study also determined that durable product manufacturers (SIC groups 19, 32-29) provided the largest domestic market for computers, using 22.2% of the value of installed computer systems in the country. Federal, state, and local government followed with 19.8%. Financial institutions were third with 17.8%.

IBM's largest percentage shares of the computer market are in mining and contract construction where it enjoys 88.5% of the business, and in utilities where it has 84%. IBM's weakest market share is in the government area, largely due to the reduced share of the Federal Government market it has been getting in recent years. IBM's share of the Federal market for commercial systems dropped from 60% in 1964 to 57% by the end of '65. (See C&A Market Report, Oct., '66.)

Table 1 gives a summary of the results of this study. Below is a definition of the S.I.C. (Standard Industrial Classification) market codes used in this study.

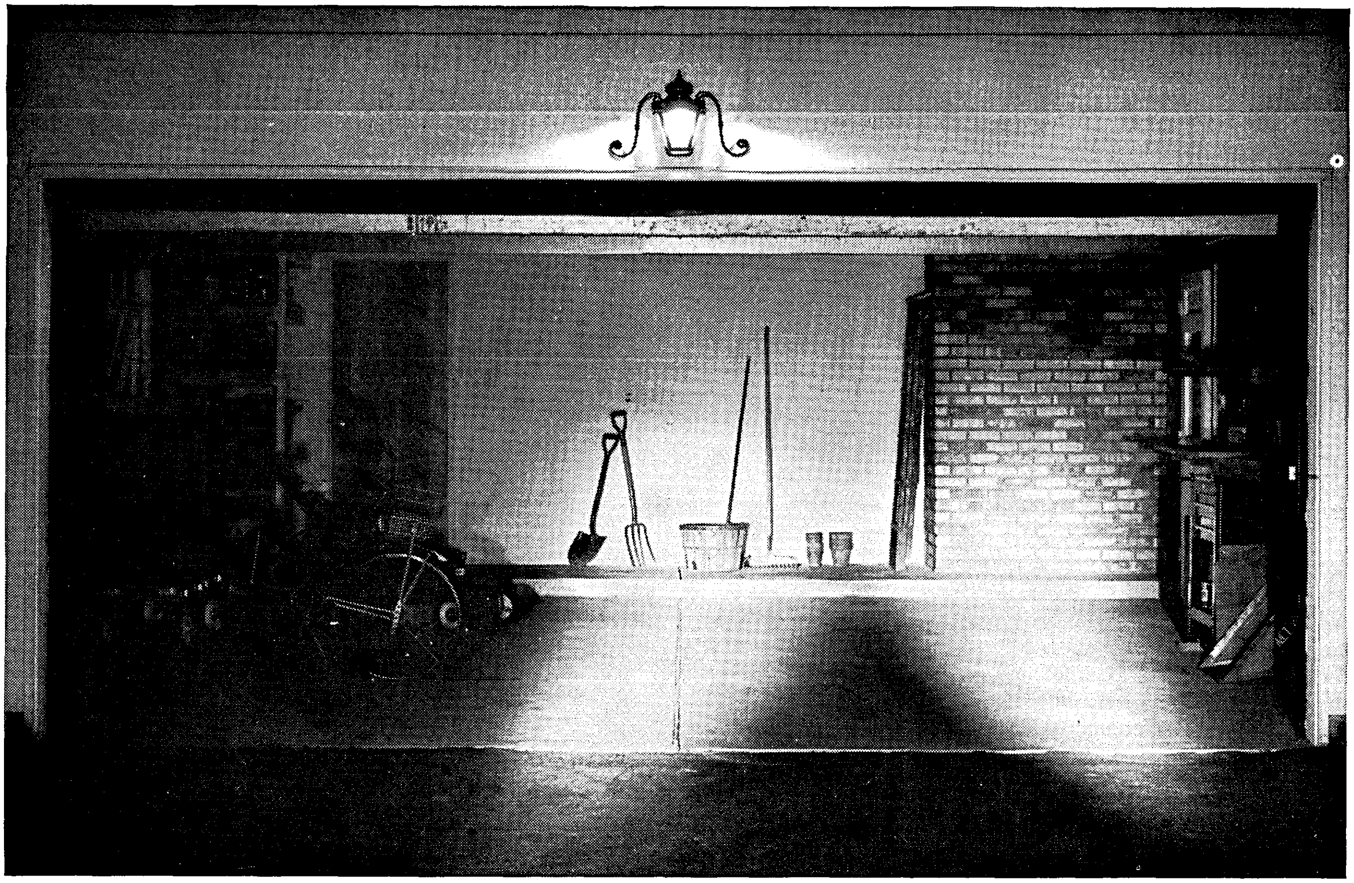
Industry or Activity	S.I.C. Group
Agriculture, Forestry and Fisheries	01 - 09
Mining and Contract Construction	10 - 17
Chemical and Natural Product Processing including Food, Tobacco, Textiles, Woods, Wood Products, Paper, Publishing, Rubber and Leather Products	20 - 31
Durable Products Manufacturing including Stone and Glass Products, Primary Metals Industries, Fabricated Metal Products, Machinery, Transportation Equipment, Scientific and Professional Apparatus Ordnance Equipment	19, 32 - 39
Transportation, Communication and Other Public Utilities	40 - 49
Wholesale and Retail Trades	50 - 59
Finance, Insurance and Real Estate	60 - 69
Business and other Non-Professional Services	70 - 79
Medical, Educational and Other Professional Services	80 - 89
Federal, State, City and Local Government	90 - 99

TABLE 1.

SHARE OF THE U. S. COMPUTER MARKET BY INDUSTRY GROUP
% BY MANUFACTURER; FIGURES IN $MILLIONS
COVERS INSTALLED GENERAL PURPOSE DIGITAL COMPUTERS

Manuf. \ S.I.C. Group	01-09	10-18	20-31	19, 32-39	40-49	50-59	60-69	70-79	80-89	90-99	Total Value of Installed Sys.	% of Total Market
Burroughs	0.6%	1.9%	1.6%	2.0%	0.7%	1.3%	8.2%	3.3%	4.0%	1.9%	$259.0	3.14%
Control Data	<0.1%	2.8%	1.8%	5.2%	0.2%	<0.1%	<0.1%	6.0%	9.1%	9.9%	372.8	4.53
General Electric	<0.1%	0.2%	1.1%	3.1%	0.6%	<0.1%	4.3%	2.3%	1.2%	1.7%	182.2	2.21
Honeywell	6.1%	0.8%	3.2%	3.0%	2.3%	5.0%	3.3%	4.4%	1.9%	3.0%	253.2	3.07
IBM	80.4%	88.5%	80.4%	72.2%	84.1%	80.9%	72.3%	71.6%	76.1%	65.0%	6,063.2	73.67
NCR	7.4%	1.1%	2.0%	1.5%	0.4%	4.6%	4.5%	2.5%	0.8%	2.4%	190.1	2.31
RCA	<0.1%	0.6%	2.5%	2.5%	5.3%	1.0%	3.2%	1.0%	0.2%	4.5%	235.4	2.86
Sperry Rand Univac	5.5%	3.1%	6.2%	8.3%	5.6%	6.9%	4.1%	5.6%	4.6%	8.9%	540.4	6.57
Others	<0.1%	1.0%	1.2%	2.2%	0.8%	0.1%	<0.1%	3.3%	2.1%	2.7%	135.0	1.64
Total Value of Installed Computers	$9	$195	$817	$1824	$674	$381	$1461	$576	$662	$1632	$8,231.1	
% of Total Market	<0.1%	2.4%	9.9%	22.2%	8.2%	4.6%	17.8%	7.0%	8.0%	19.8%		100%

Source: Computer Installation Data File of International Data Corporation, Newton, Mass. 02160



COMPUTERS LARGE OR SMALL?

IN WHICH DIRECTION WILL THEY GO?

Rudy C. Stiefel, President
Infotran, Inc.
New York, N.Y.

"Technically, the computerized typewriter may be nothing new. Practically, it may mean a change as huge as the success of the desk-top copying machines — even though the technical capacity to make copies had existed for many decades."

Once upon a time, not too long ago, the status of computer companies was determined by how many square feet of space their equipment occupied and how many tons of air conditioning it needed. The "almost block long" computers were undisputed kings. A little later, computers with the highest transistor count were considered the ultimate in sophistication.

This is no longer true. As the art and the applications progress, such "sophistication" becomes increasingly unnecessary.

Now it is considered fashionable to call one's computer "desk top" — although often a very special "desk" has to slip underneath or by its side to support it physically and electronically.

Desk-Top Computers

A great many desk-top computers have made their appearance during 1965-66. A prime advertising point has been that they are fast and noiseless compared with their mechanical predecessors. In some models this is the only advantage.

Many manufacturers, however, have provided some additional, significant advantages:

1. The ability to store many numbers.
   (It is difficult to store more than a few numbers in a mechanical desk top computer.)
2. The ability to accept machine inputs and produce machine outputs; that is, outputs that can be used again as inputs either in part or in total.

Punched tapes, punched cards, or special inserts are the most commonly used machine input/output media. Even though relatively slow, they are flexible, compatible, and economical; they expand greatly the memory and programming capacity of the small computer and provide a vital key for the future increase of small computers.

Automatic input and output are very important even for small computers, because the time for manual keying for input and manual reading and transferring of output largely overshadows the time for computing. Also this kind of manual work is very unsuitable for the human brain, which here is famous for the quantity of its errors.

Flexibility, Compatibility, and Other "Nice Things to Have"

Users of large computers often overlook the high cost of flexibility, often called programmability, as well as the high cost of programming.

Flexibility is of course a desirable quality. When computers were first built and their cost and complexity were extremely high, flexibility was the manna from heaven that accelerated the introduction of computer applications into diverse fields and, occasionally, even made computer operations economical.

In the last decade, however, the cost and complexity of central processing units has gone down continually. Users have often forgotten or did not notice that a large part of the remaining hardware was due solely to "flexibility," represented by programmability, and requiring switching from one function to another at very high speeds. So an excessive amount of equipment resulted, and competed with and frequently outweighed the prime purposes for which computers were designed.

The High Cost of Programmability

We need to remember in data processing that:

> What is "soft" is not necessarily flexible, —
> and what is "hard" is not necessarily inflexible.

The earlier demand for large, complex computers has caused the problems of programming to increase "faster than new programmers can be trained." Now, with the arrival of powerful small computers, it is time to reconsider: is an increase of programming efforts a step in the right direction?

Many a large computer application has been stymied by becoming involved in an unmanageable programming effort that overshadowed the original problems.

Another consideration should be the difficulties that two of the most outstanding computer manufacturers experienced with their extra-large computers: IBM with its Stretch Computer and Control Data with its CDC 6600. One may say these were just unprofitable products, but I believe the reasons go deeper: Very large computers are out of step with the main stream of the data processing industry. The applications for super-computers will be restricted to relatively few, though important, specialized requirements in scientific and economic fields.

Time-Sharing, 1966

This was a year when more was heard about time-sharing than about any other single computer subject. But great joy and acceptance has yet to come from the users rather than from advertising departments.

In some cases a central data processor is decidedly the right solution because of the centralized nature of the problem. However, in most cases the logistics of using a remote computer, together with the extra cost and complexity of programming and data communications, make the universal acceptance of time-sharing less than a foregone conclusion.

Where local computational ability is required, the small computer will be the answer because it has no problem of data communications. Also it is devoid of the logistics problems of having to share a central facility.

Centralization vs. Decentralization

Which is better: centralization or decentralization? As illustrated in political philosophy as well as in household chores, there is no universal answer to this question. Which is better depends on the nature and quality of available facilities. Traditionally, computer problems have been considered on a large scale. The more difficult the problem, the greater, it was thought, the computer and programming effort had to be.

In the attempts to settle new problems permanently, however, the analysis and programming has often taken so long that the underlying basic factors have changed in the meantime. Many major military and commercial efforts have died a slow death of suffocation by sophistication, because it took too long to get results, and in the meantime, the surrounding situation had changed.

"Soft" Hardware and "Hard" Software

The problem of how flexible a computer should be can also be expressed in the question, "How 'soft' should hardware be?" The companion question, "How 'hard' must software be?" is generally answered, "Let it be as flexible as possible." But it should not be forgotten that the difference betwen software and hardware is not distinct, but rather it is one of common usage. Eventually, all "software" has to find its "hard" expression in a piece of hardware such as magnetic tape, punched cards, or a "hard" copy of printed material.

It is desirable to look at software and hardware as a unit. The advantage is that this often leads to a more useful and economical instrumentation of a problem solution. With an open mind, flexibility can be greatly enhanced by the right combination of software and hardware.

Super-Storage and Super-Retrieval

Most of the advances in information handling in the past decade have been in the application, cost, and reliability of information transformation. The ability to store has changed relatively little.

Super-storage has always been available, but not super-retrieval. Huge amounts of information can be stored on tape or, for that matter, in printed form; but accessibility has so far been somewhat inversely proportional to storage capacity.

In spite of many efforts for improvement, information retrieval remains a great technical and conceptual roadblock in information technology. The solution to the popularly-called "information explosion" is severely hampered by lack of retrieval technology and by a basic lack of definition and understanding of what information is and what it is not.

Large Computer, Small Computer, No Computer?

Voices of disenchantment have been raised in the last few months. For the first time, it has become fashionable to throw the computer out and replace it again with a "personal touch." "Our attempts to utilize electronic data processing in billing our accounts have been unsuccessful, it has caused us to become too mechanical in our handling of our subscribers," writes an answering service to its subscribers. This is in sharp contrast to previous habits of bragging about the computer standing in the corner, even though it had barely been unpacked.

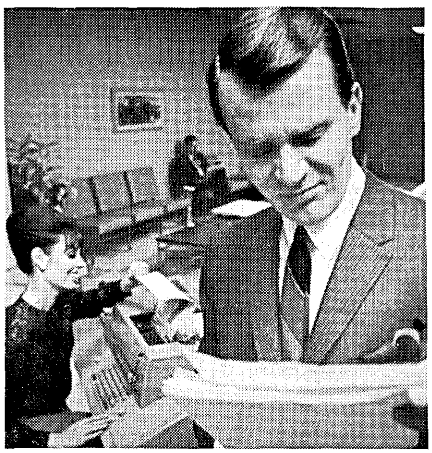
Many of these problems have been caused by overselling large general purpose computers to customers who had only limited, special problems; and the customers then got entangled in endless programming efforts rather than in solving their problems.

To be sure, for very dissatisfied customer of electronic data processing there are ten satisfied ones. There are even some who could no longer operate without electronic data processing. Nevertheless, it is in the interest of everyone concerned with the industry to avoid dissatisfied customers, and to consider "when *not* to use a computer."

The Computerized Typewriter

The day of the "computerized typewriter" is coming. In the past, typewriter-like devices have been used for various odds and ends on the periphery of computer systems. The next few years will see a reverse trend. Typewriter-like devices, which have computing, memorizing, selecting and processing capabilities will make the computerized typewriter compete in popularity with the present electric typewriter.

Technically, there may be nothing new. Practically, the computerized typewriter may mean a change as huge as the success of desk-top copying machines — even though the technical capacity to make copies had existed for many decades.



HOW TO COLLECT, INTEGRATE AND DISTRIBUTE DATA

If any one symbol can represent the rapid changes of the "sizzling sixties," it's the computer. Data processing has won not only wide acceptance as a vital function of efficient business operations, but is growing more sophisticated with greater reliance on real-time operations.

In turn, this reliance on real-time processing has placed renewed emphasis on data communications. Data must be available quickly for management to make timely, accurate decisions. And, regardless how sophisticated your data system may be, Teletype sets remain the simplest, most reliable and least costly terminal equipment for collecting, integrating and distributing data.

The integration of communications within data processing systems has helped solve many business problems by:

- Assuring management of adequate, timely information to make accurate decisions,
- Eliminating the costly errors caused by duplicated paperwork,
- Speeding distribution by cutting costly paperwork,
- Reducing customer complaints, and
- Enabling management to communicate quickly with remote computer centers.

Getting data in time for decisions Nothing can be as useless to you as information that arrives too late. Wrong decisions are made. Production is slowed. Deliveries are late. Customers are dissatisfied or lost. Yet, none of these situations need ever exist.

Using Teletype machines for communications within a data processing system, assures you of getting information where you need it — when you need it. You'll be able to make better informed, more timely decisions that could spell the difference between profit and loss.

This problem faced a New Jersey food processor, who had been receiving sales and inventory statistics by mail from its two branch offices. By the time these reports were processed, the information was too old to use in reaching important management decisions. The processor had Teletype ASR (automatic send-receive) sets installed at all three locations. Now, daily statistics are received in minutes and processed into up-to-date reports. This reduces inventory costs and enables the processor to close its books eight days earlier each month.

Eliminating duplicate paperwork errors How often do errors in order processing result in producing the wrong size or quantity? How often have prices been misquoted or customers lost due to incorrect shipments? These **are typical** problems

SMALL COMPUTERS AND THEIR BIG ROLE

George A. Zimmerman, Vice Pres.
Scientific Control Corp.
Dallas, Texas 75234

"Someday primary schools will have children using small computers, and parents will have one at home for mom, dad, and the kids."

Small computers every day are juggling larger and more intricate data problems, and they have not yet begun to pant. These mighty midgets are switch engines of the data freight yard. They can gather, organize, and reroute information faster than the huge data trains on long information tracks.

Low Cost

Fast and versatile small computers are now within the reach of scientists, lawyers, engineers, doctors, and teachers. They are within the budgets of process control, equipment testing and data analysis departments. Instrument users now rival system designers in their employment of small computers, to be their data traffic policemen.

Independence

Many manufacturers now offer processors, software, and maintenance so that the buyer can be independent. The software provided usually includes a symbolic assembler, a Fortran compiler, mathematical subroutines, utility programs, with debugging aids, diagnostic routines, and programmer courses. Maintenance usually includes a display console with computer control, and diagnostic capabilities, spare parts kits, factory repair for serious problems, maintenance documentation, and maintenance training.

Choice

Processors costing less than $50,000 vary in cost versus performance, from the level of an abacus to the capacity of a heavenly angel employed at the minimum wage. The central problem is how the buyer, user, or system configurer should select a small computer to do his immediate tasks and have the potential for future planned activities.

Higher-speed processors are not always an advantage. High speed is never employed in some applications of small computers. Instead, input/output capability and various types of independent memory action are often more important. The reason is the slowness of in-and-out devices.

Software

Software assemblers change programmers' symbols into machine language: a symbolic program is converted into a binary program. A great many users of small computers have the technical proficiency to define and program their applications for these computers.

Manufacturers offer varying degrees of Fortran capability compared to the American Standards Association Fortran standards. The scope of the Fortran compiler varies according to such factors as memory availability, input/output capabilities, and the diagnostic depth desired. Utility and mathematical programs are provided to assist debugging and changing of programs as well as to enable users to write programs easily.

Integrated Circuits

Solid-state circuits and integrated circuits have reduced the cost, space, and installation requirements of computers. Standard 115 volt alternating current at 60 cycles per second and low current drain are normal for small computers. So the efforts for preparation of computer sites and the investment for them have been materially reduced.

The midget computers are very versatile. Optional features include: direct conversation with memory sections while processing continues; protection of memory against power loss or inadvertent overwriting; automatic parity check at points in the internal activities of the computer where error probability is highest; various priority interrupt systems; input/output buffering of data.

The best computer and system for an application requires detailed analysis of internal processing capabilities as well as definition of economic and equipment factors. Small computers may be connected to all peripheral storage, display, communication, and human interface equipment.

Small computers have hundreds of applications, and thousands of the midgets are in operation. Following are some examples.

Controlling Data Input in Real Time

Two data handlers of approximately $28,000 each were designed to go into a multiprocessor computer system to provide reliability for a user collecting data in real time. The computed results controlled equipment related in time to the data being received. The throughput rate of each processor was 50% greater than the rate of data arrival, and the needed rate of computation.

In this application a multiprocessor control could automatically detect and turn off a faulty processor and switch the processed output from the remaining computer running correctly into both processor memories. A human being could control the system through a typewriter, a paper tape reader, or a processor console.

Controlling Data Display Devices

A data handler with a memory of 8000 words and five microsecond cycle time was used as a controller to drive various display devices. Programs were entered by paper tape and then stored on magnetic tape, which also held the data to be displayed. The processor, which cost about $37,000, could normalize, linearize, convert, sort, and store data. Its output included control of high speed plotters and displays, a line printer, a cathode ray tube bar graph, and a strip recorder. Data were sent also to a larger computer.

Accepting Data and Storing It on Magnetic Tape

Another $37,000 data processor with 4000 words of core memory and a cycle time of 1.75 microseconds was used to accept high-speed data and store it on magnetic tapes.

The rate of input data, approximately 100,000 24-bit words per second, was easily handled by use of an interlace control which had the ability to input data directly into the memory. A second interlace control was used to unload the memory onto three magnetic tape units operating at a rate of 120,000 characters per second. An appropriate selection of internal computer characteristics provided a rate of writing on tape greater than the rate of real-time data input.

Some input devices require a processor to interpret the gathered data, arriving at high speeds, in order to achieve maximum benefit.

Electronic Optical Character Readers

Electronic optical character readers require an associated small computer in order to manipulate data at high speeds. Also the computer has to have random access storage to gather the data; it has to determine the nature of a character by comparing it with its memory of images; and it has to process the information in order to display it or to store it.

Some Other Uses

Many small processors are being used by professional men in every field to perform mathematical and statistical studies, to analyze data, simulate activities, solve problems, and make computer designs. System and instrument manufacturers have turned to small computers where in the past they might have employed fixed-wire logic, and have also used small computers to perform inventory checks, computations, and recording for statistics and for display.

One of the most frequent and increasing uses of the small data handlers is to service large computers. Many a minor "computer Hercules" is fully utilized gathering, editing, and formatting data to send to a larger processor. Also, large central processors send data to small computers for display equipment control or transmission over distances.

Small computers are used to receive data from all types of instruments and sensors in industry, university, scientific, military, medical and engineering applications. Representative analog signals are received from communication channels and multiplexed through an analog-to-digital converter to the computer. Small computers can accept many channels of input, depending in large part on the rate of the input signals and the processing speed of the application programs.

Effects on Education and Society

The computer industry started with large processors at high cost, and only a few people who could understand the technology. But now the principles of computers are understood by rather a large segment of the American people, and a great many small computers are in thousands of places.

The "new mathematics" being taught in elementary and secondary schools associates the calculating methods of the schools with the methods of electronic computation. Young people are learning number bases and the binary numbering system that utilizes ones and zeros, which correspond with the presence or absence of electronic signals in a computer word. Small computers are being bought by colleges, junior colleges, and high schools, to teach data processing, computer organization, and mathematics. Cousins of the existing small computers are on drawing boards; when they are built, they will be much smaller and more versatile for the dollars that they will cost.

In fact, some day, primary schools will have children using small computers, and parents will have one at home for mom, dad, and the kids.

THE ROLE OF THE BLIND IN DATA PROCESSING

Theodor D. Sterling, Ph.D.
Joseph B. Landwehr, B.A.
Charles McLaughlin, B.A.
Seymour V. Pollack, M.Ch.E.
Medical Computing Center, College of Medicine
University of Cincinnati
Cincinnati, Ohio

"Thus we have a triple combination of skills and attitudes which the sighted person possesses in part but has never trained to the pitch of perfection as has the blind individual."

Note: Work on this project was supported in part by VRA grant RD-1485 and NIH grant FR-00010. Many thanks are due to the Department of Rehabilitation of the State of Ohio and to the Cincinnati Association for the Blind for invaluable help received over the years.

Imagine that you are asked to evaluate a candidate for a job as a programmer. The applicant appears to be extremely intelligent. He has shown himself to be very inventive. He seems to have a number of outstanding capabilities which point to him as an especially gifted programmer. There is no question but that he is highly motivated to do well in his profession. He can show that he is well trained in all aspects of computation and related topics. He also appears to have a good general education besides being personable. Yet, despite these desirable qualifications, the applicant may be disqualified because he is blind.

An Occupational Opening

Of course the question is: Is it really a handicap to be blind as a computer programmer? Or is it possible that being blind also brings with it certain advantages that counteract this sensory loss? Indeed there appears to exist a rather unique situation where an occupational outlet has opened to the qualified blind in areas touching computer work and where the blind have also turned out to be extremely suitable employees. I would even go as far as to say that there exists a relatively small number of blind individuals who are uniquely qualified for all areas of work related to computation. Basically these are the blind who are able to get around and meet demands of their environment without undue assistance and who can move through the world on their own.

(Reprinted with permission from "Proceedings of the Third Annual Computer Personnel Research Conference, June 1965, published by the Computer Personnel Research Group, Applied-Physics Laboratory, The Johns Hopkins University, Silver Spring, Md.)

Meeting the normal demands of the environment is a rather large order for a man or woman who is deprived of sight. It requires that the individual has an above average endowment of intelligence and is reasonably inventive. To the advantage of our profession, the requirements made by the day to day environment on the blind also force him to acquire and maintain a series of habits and skills which make him uniquely suited to work with computers.

Intelligence

The native intelligence of the class of individuals who are blind and yet are able to move through their environment without particular assistance is indisputable. To go to school, to learn a trade, to negotiate the many obstacles that have to be hurdled in any endeavor, requires, on the part of the blind, considerable basic ability. Let us take the problem of study as an example. Here the blind student has to spend large amounts of time in organizing his person and his room so that he is left with relatively small amounts of time to devote to his school work. It means that if he is acquiring knowledge and skill on the level of a sighted individual, he does so by devoting much less time to learn this particular subject, topic, or skill than does the latter. Nor does he have the opportunity of a quick review of his notes or of other references. The blind student must learn and acquire the same amount of knowledge as does the sighted yet in a fraction of the time which the former has to devote to it. Yet, it is precisely the amount of time needed to learn a unit of information that constitutes a basic index and measurement of intelligence.

Inventiveness

There is also no question about the fact that the blind individual must be extremely inventive. Many problems of daily living exist which have to be resolved. These problems include how to find a stylus or a book, how to find clothes and decide whether or not they are clean, how to recognize denominations of money. These extend to the many hundreds of thousands of tasks which make up daily life. Many of these problems are so trivial that it would appear hardly worthwhile teaching them formally; yet they are so numerous that they would choke off the normal flow of affairs if permitted to exert undue pressure. As a consequence, the blind individual must solve a constant stream of small problems and do so without disrupting his main purpose of the moment. He cannot do so without constantly inventing problem solutions — virtually as a habit.

Besides intelligence and inventiveness, certainly two very useful traits, the blind individual acquires a set of habits and skills which are peculiarly suited to prepare him for work as a professional programmer: organization of memory and spatial orientation.

Organization

The active blind individual must be extremely well organized. He must be able to find things after he puts them down. He must be able to recover his possessions, his notes, information and other tools, utensils, and what have you. To accomplish this the blind must develop a very well trained memory. The fact that he has successfully concluded his schooling is by itself a sign that he has learned to rely on his memory and has trained it to the point where he can acquire new information and integrate it with what he already knows quickly and easily.

Spatial Orientation

The other skill and facility the active blind must develop to perfection is to get around in his environment. The spatial orientation acquired has many advantages. The active blind almost has a sixth sense of where things are, where they are going to be, or where they could possibly be. Spatial orientation is terribly important to the blind individual who can be grievously hurt if he does not acquire it. However, this orientation apparently carries over into programming work since the inside of the computer's memory is, from a functional point of view, no different from the other parts of the environment.

Thus, we have a triple combination of skills and attitudes which the sighted person possesses in part but has never trained to the pitch of perfection as has the blind individual. His knowledge is well organized. His memory is trained to receive new information and to integrate it with the old. Thus it is easy for the blind to keep the total programming job or system in mind. Finally, he can orient himself in unseen geometrical space and thus treat such problems as the movement of instructions in the computer's memory or the indexing of program steps in the same fashion as he treats the ordering of his pencils in his drawers or finding a book which might possibly move around his bookshelves.

Desire to Perform

So far we have endeavored to give some indication that the blind, who would apply for a position in computing establishment or seek training for it, is very well suited for this type of job. Does he have the desire to perform in the job environment of a computing installation?

Here again are a number of factors which predispose the blind toward the profession of programmer. The first one is very obvious. Since, despite the fact that there are many gifted blind, the opportunities are rather restricted, it makes the job much more valuable for him than for his sighted counterpart who, after all, can lift himself up and leave for another position almost at will. There is another unique motive present. The opportunities for intellectual outlets for the blind are obviously fewer than for the sighted. It turns out that programming itself is an intellectual challenge enjoyable in its own right. We have very often heard blind professionals link their preoccupation with programming problems to that of the sighted concerning the game of bridge. Indeed the analogy seems to be very appropriate.

We have so far spoken about the advantages and special disposition of a group of active blind individuals for work with computers. But how about the handicaps which blindness represents in their work? There is, of course, no denying that blindness is a handicap. It would be silly to present it as anything else. Even if it is accompanied by certain training and habits which might select out some blind individuals as very desirable employees, the fact still remains that in the performance of any job the blind individual has obstacles to overcome. How about these with respect to programming?

Printouts in Braille

The major difficulty in the performance of the job of a programmer who is blind lies in the fact that the computer produces rather large quantities of printouts which have to be read. Indeed, the inability to read printed output kept the blind from the profession until a number of years ago when this problem was solved in a very simple and straightforward manner. It turns out that any high speed printer without modification, can be used to emboss paper in such a fashion that it can be felt by the blind individual. This means that it is possible to construct a simple system that will translate all computer output into its braille equivalent and emboss it on regular paper so that the blind can read it as well as the sighted. Practically the only modification required of the printer is that a strip of elastic be taped behind the print hammers, that the pressure of the printing hammers be increased to its maximum, and that a program translates alphameric characters to their braille equivalents.[1,3] The first two modifications take at the most a half to a minute of operator time. The second modification involves systems skills. The incorporation of a brailling routine into executive procedures demand system writing on some level of sophistication. Blind individuals who have finished an adequate course of training are often capable of providing this systems work themselves. Where they cannot do so or where the required systems work would be too expensive there exist vehicles by which such systems work can be obtained or purchased with help of state or federal rehabilitation agencies.

Other Questions

There are a number of other questions for which the potential employer ought to have answers.

How Does the Blind Programmer Get His Job Assignment?

He gets his assignment very much like the sighted programmer. The supervisor, programmer, or analyst talks to the programmer and explains the problem to him. Instructions and specifications might also be taped, if suitable, so the blind can peruse them at his leisure. A Sewell board, a wooden clipboard with a plastic sheet over it, can be used to draw diagrams which the blind is able to follow. Just as his sighted counterpart, the blind programmer probably will write notes but his will be in braille. Finally, the writeup of a problem may be put through the brailling routines which are described above.

How Does the Blind Programmer Get His Program Written and Punched?

There are a number of techniques to block out the flow of the problem and its solution. Usually the blind programmer uses a set of cards, putting a statement describing the function of a particular block on each card.

There are a number of ways in which programs are prepared for the keypunch operator. The usual method is for the blind programmer to type his program. He or she may also write in script on specially prepared program sheets. Another method that has been used is to dictate a program and have it coded either by a clerk or have it punched directly from the recording.

How Does the Blind Programmer Debug?

All statements which the computer would ordinarily make in alphameric characters are translated into braille and embossed by the printer. They are then read as would be ordinary output for the sighted.

A programmer is seldom called on to do console debugging. However, there are some situations in which this ability is required. The programmer may work for a small installation in which he must debug his own problems on the machine as well as run his own jobs. In other instances the programmer might work at very complex systems for which console debugging and manual cycling will save a lot of time. The console operation does not confront the blind programmer with any particular difficulties.

A light sensitive probe may be used to translate light signals into sound. The probe is simply used to scan the console and read the lights. Operation of switches, knobs, and other manipulative protuberances obviously offer no difficulties.

Card readers exist which enable the blind programmer to check particular cards quickly.

What Is Documentation?

The blind programmer will document his program in the usual fashion. All he needs to do is to specify to the typist the symbols he wishes to use. These are then translated into the customary flow chart.

In a similar fashion the blind can pick up a program written by another person. Someone must read the flow chart to him and trace out its intricacies. The blind programmer has his own methods to record the flow chart for future use. It is noteworthy that flow charts can be brailled also on the high speed printer.

How Do Blind Programmers Get Around on the Job?

Before venturing on the outside on his own, the blind person has been trained to locate himself and objects in his environment by a variety of methods. It is usually necessary to take the blind employee around his job environments to show him the location of his own desk or work area, that of the supervisor's, the washroom, installation equipment he is to use, the cafeteria. He will then find his way on his own.

How Do Blind Workers Relate to Their Colleagues?

The blind programmer will make a normal adjustment to his colleagues. Blind employees are aware of difficulties which they may have in relating to their environment and fellow workers and will handle these very well on their own. By and large, the same rules apply to all. Co-workers ought to treat each other with courtesy and consideration. It is true that the blind worker will need no more and no less help and association than does the sighted one.

The number of blind women programmers presently employed in the industry is small. However, since the number of women programmers in general is relatively large when compared to other professions, there ought to be no particular difficulty in integrating the blind woman programmer in the staff of any installation.

What Is the Approximate Number of Blind Professionals That May Be Anticipated to Seek Employment?

The number of blind persons who are both able and interested in working in the field of computer programming is relatively small. Some blind people have a difficult time in dealing with their environment and prefer a sheltered environment. Obviously, these will not apply for employment.

Those who do apply will tend to be the more aggressive, intelligent, and able. It is difficult to estimate the number of potential applicants for training in this field. One estimate places the number of potentially suitable candidates that may be eligible throughout the country at 200 yearly.

The choice of programming and computer work, like all other occupations, depends on many factors.

It is anticipated, however, that in the next few years a relatively large number of blind individuals will attempt to get training and placement in programming. There is a backlog of individuals who would have taken training if this professional opportunity had been available and there had been easy access to training resources.

What Sort of Educational Preparation Does a Blind Programmer Have?

At this time there are many blind college graduates who are turning to programming as a means of employment. Some of these have had little preparation in mathematics or logic or both. Others may have a Bachelor, Master, or even a Doctorate in Mathematics or in another subject.

Many blind applicants for jobs or training will have no more than a high school education. It is a considerable financial sacrifice, either for the individual or for his state, to send the blind to college. College opportunities have become as open to the blind as to the sighted only recently. Experience in employment so far has shown that very good programmers can be found among the blind who have had no more than a high school education.

A lack of training in mathematics and logic is often overcome by the programmer after he is on the job through continuing education.

Where Can One Inquire About Employing the Blind?

All inquiries about blind employees or trainees should be addressed to the ACM Committee on Professional Activities of the Blind, Medical Computing Center, College of Medicine, Eden and Bethesda Avenues, Cincinnati, Ohio 45219.

There is one more aspect about the training of blind programmers which is very interesting. To our knowledge there are no schools in the country which at this time devote themselves to producing a programmer as such. It is true, there are universities that offer programs in computer sciences. The end product of such courses are individuals who operate within the computing field on the highest level of sophistication but not individuals who are functioning ordinarily as programmers. On the other end of the scale we have a number of commercial schools whose product is somewhat questionable. Training programs which have been established for the blind are unique in the sense that they devote themselves to turn out, in one year, a knowledgeable individual who can function on an intermediate level of programming skills.

As an example we list here the training program for the blind students at our own Medical Computing Center. To give some standards to the amount of material covered by each topic the equivalent number of undergraduate credits the student would have earned are given with each topic. In this outline one year's undergraduate work is counted as 34 semester hours.

1. *Training in the Use of Peripheral Equipment*

Operation of the 026 key punch, use of the card reader, use of the light sensitive console probe, familiarization with console on the 1402 card reader, the 1401 central processing unit, the 1403 printer, tape drives, sorter, and other equipment. Later on in the course the student also gains familiarity with the use of the brailler routines and set up for brailling on the high speed printer. (1 cr.)

2. *IBM 1401 SPS and Machine Oriented Programming*

The student is introduced to programming in SPS, then switched to machine language on the IBM 1401. The student is practiced in all operations, writes a variety of programs and debugs including making corrections on the assembled machine language program with and without use of tapes. He also gets hands-on experience in assembling his own programs. (7 cr.)

3. *Problem-Oriented Languages*

The student is familiarized with at least two compilers, (FORTRAN IV, COBOL, or AUTOCODER). The selection of type of compiler depends to some extent on the kind of practicum the student will undertake or possible placement which is open to him. (6 cr.)

4. *Special Aids*

The student is familiarized with and practices constantly on ways and means of negotiating his problems through the computer center. These include techniques: to type programs for use by the key punch operators; to develop flow charting and documentation procedures for a typist; writing brailling routines for different computing constellations; learning to use batch processing, by running his own and other students' programs through the machine; and getting hands-on experience in console debugging with the use of the light-sensitive console probe. It should be noted that console debugging is stressed during training as a pedagogic aid and to give the student confidence. No expectation is formed either by the student or by the people who teach him that he will ever do much work on the console after he graduates. (2 cr.)

5. *Computer Arithmetic*

The student is given a review of the mathematical techniques basic to computer arithmetic manipulations and basic training in statistics and numerical analysis. (6 cr.)

6. *Types of Peripheral Equipment*

The student is exposed to a didactic series of lectures and readings in which types, kinds, makes, performance characteristics, and so on, of various types of peripheral equipment are discussed. These include recording devices, A/D and D/A converters, analog computers, digital-analog hybrids, and other hardware possibilities. (3 cr.)

7. *Systems*

A series of lectures (usually one a week) cover the construction of assemblers, compilers, and executive systems. (3 cr.)

8. *Applications*

A lecture series in the latter part of the course familiarizes the student with a variety of applications in business, industry, and the sciences. The aim is to familiarize the student with peculiarly useful techniques and current methods of solving scientific and business computing problems. (3 cr.)

9. *Professional Problems*

A lunch seminar once a week is used to discuss training and professional problems with the student. These sessions deal with professional problems unique to the programming and computer professions and also to problems concerning the blind in this industry. (no cr.)

10. *Practicum*

Arrangements have been made with local industry to give the student two to four weeks supervised experience in a work setting. (3 cr.)

The end result of this program is an individual who is knowledgeable in general areas of computers, who has mastered a number of machine and problem-oriented languages, and has some idea about compilers, systems, and related topics.

We have tried to describe the many facets that are involved in the development of employment opportunities for the blind in the EDP related industries. We hope that we have shown that there are gifted and capable blind people who are extremely well suited for the work with computers as well as that the present training efforts produce an extremely employable individual. Indeed, there are now some 50 blind programmers gainfully employed in the industry and this number is constantly increasing. The Association for Computing Machinery has information on where these blind individuals are employed as well as the names of their immediate supervisors. The latter will be happy to give additional information of their own experience and ought to be consulted by all means.

One final thought concerns the amount of help one would think a blind programmer needs. Very often, in employing the blind individual, the immediate supervisor is very much concerned with the fact that this individual will obviously need some help and cooperation by fellow employees and others. This is, of course, perfectly true. However, one ought not to depart from the proposition that the blind individual needs help as contrasted with the sighted individual who doesn't. All of us, blind or sighted, need a certain amount of help in our jobs as well as in our daily lives. It is probably true that the blind programmer needs no more help in the performance of his job than does the sighted. Only the kind of assistance needed may differ.

Bibliography

1. Landwehr, J. B., McLaughlin, C., Mueller, H., Lichstein, M., and Pollack, S. V.: BLNSYS — A 1401 Operating System with Braille Capabilities. *Communications of ACM 8:* No. 5, 300-303, 1965.
2. Landwehr, J. B., and McLaughlin, C.: Flow Charts for the Blind Programmer. *Communications of ACM* (in press).
3. Sterling, T. D., Lichstein, M., Scarpino, F., Stuebing, D., and Stuebing, W.: Professional Computer Work for the Blind. *Communications of ACM 7:* No. 4, 228-231, 1964.

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION
(Act of October 23, 1962: Section 4369, Title 39, United States Code)

Publisher: File two copies of this form with your postmaster.

1. DATE OF FILING: OCT 1, 1966

2. TITLE OF PUBLICATION: COMPUTERS AND AUTOMATION

3. FREQUENCY OF ISSUE: MONTHLY

4. LOCATION OF KNOWN OFFICE OF PUBLICATION *(Street, city, county, state, zip code)*: 815 Washington Street, Newtonville, Mass. 02160

5. LOCATION OF THE HEADQUARTERS OR GENERAL BUSINESS OFFICES OF THE PUBLISHERS *(Not printers)*: 815 Washington St., Newtonville, Mass. 02160

6. NAMES AND ADDRESSES OF PUBLISHER, EDITOR, AND MANAGING EDITOR

PUBLISHER *(Name and address)*: Berkeley Enterprises Inc., 815 Washington St., Newtonville, Mass. 02160

EDITOR *(Name and address)*: Edmund C. Berkeley, 815 Washington St., Newtonville, Mass. 02160

MANAGING EDITOR *(Name and address)*: Edmund C. Berkeley, 815 Washington St., Newtonville, Mass. 02160

7. OWNER *(If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given.)*

NAME	ADDRESS
Edmund C. Berkeley	815 Washington St., Newtonville, Mass. 02160
William L. Mandel	G.P.O. Box 395, New York, N.Y. 10001
James J. Cryan	33 Sandra Lane, Wayne, N.J.

8. KNOWN BONDHOLDERS, MORTGAGEES, AND OTHER SECURITY HOLDERS OWNING OR HOLDING 1 PERCENT OR MORE OF TOTAL AMOUNT OF BONDS, MORTGAGES OR OTHER SECURITIES *(If there are none, so state)*

NAME	ADDRESS
none	

9. Paragraphs 7 and 8 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner. Names and addresses of individuals who are stockholders of a corporation which itself is a stockholder or holder of bonds, mortgages or other securities of the publishing corporation have been included in paragraphs 7 and 8 when the interests of such individuals are equivalent to 1 percent or more of the total amount of the stock or securities of the publishing corporation.

10. THIS ITEM MUST BE COMPLETED FOR ALL PUBLICATIONS EXCEPT THOSE WHICH DO NOT CARRY ADVERTISING OTHER THAN THE PUBLISHER'S OWN AND WHICH ARE NAMED IN SECTIONS 132.231, 132.232, AND 132.233, POSTAL MANUAL *(Sections 4355a, 4355b, and 4356 of Title 39, United States Code)*

	AVERAGE NO. COPIES EACH ISSUE DURING PRECEDING 12 MONTHS	SINGLE ISSUE NEAREST TO FILING DATE
A. TOTAL NO. COPIES PRINTED *(Net Press Run)*	12,925	13,000
B. PAID CIRCULATION 1. SALES THROUGH DEALERS AND CARRIERS, STREET VENDORS AND COUNTER SALES	0	0
2. MAIL SUBSCRIPTIONS	8,324	10,800
C. TOTAL PAID CIRCULATION	8,324	10,800
D. FREE DISTRIBUTION *(including samples)* BY MAIL, CARRIER OR OTHER MEANS	3,077	879
E. TOTAL DISTRIBUTION *(Sum of C and D)*	11,401	11,679
F. OFFICE USE, LEFT-OVER, UNACCOUNTED, SPOILED AFTER PRINTING, AND FOR SALE AS BACK COPIES	1,524	1,321
G. TOTAL *(Sum of E & F—should equal net press run shown in A)*	12,925	13,000

I certify that the statements made by me above are correct and complete. *(Signature of editor, publisher, business manager, or owner)* Edmund C. Berkeley

POD Form 3526 Jan. 1965

LEARNING AND ARTIFICIAL INTELLIGENCE ACCOMPLISHED BY COMPUTER PROGRAMS

Thomas A. Throop
Research Analysis Corporation
McLean, Va.

"If a computer program is to display highly intelligent behavior in response to repeated experiences in a complex problem environment, then rote learning, generalized learning, and heuristic learning should be used together as complementary techniques."

Is it possible for computing machines to think? The answer to this question depends on what is meant by "thinking." If one defines thinking as an activity peculiarly and exclusively human, then the answer to the question is "no," since any such behavior would have to be called "thinking-like" behavior. However, if one defines thinking as displaying certain behavior which includes deduction, certain inductive process, and selective creativity, then the answer is "yes."

Intelligent Behavior

Though the field of artificial intelligence is still in its early development, several computer programs have been developed which demonstrate behavior which we would term "intelligent behavior" of "thinking," if exhibited by a human being. Various degrees of success have been achieved, depending in part on the complexity of the problem chosen for the artificial intelligence research. For instance, a checker-playing program good enough to defeat the former Connecticut State champion has been developed, while the efforts in developing chess-playing programs have not produced a program of equivalent capability.

What are the limits of artificial intelligence research? One well-known researcher in this field suggests that there exists a continuum of intelligent behavior and that the question of how far we can extend the behavior of machines out along this continuum is to be answered by research. While the computer programs which have been constructed thus far are still at the low end of this continuum, no evidence or logical argument has been advanced which demonstrates an insurmountable hurdle somewhere along the continuum. Therefore, there is no reason not to believe that perhaps some day computer programs will reach or surpass the milestone that represents the capabilities of human intelligence.

Today's computers, even with their limited capability along this continuum of intelligent behavior, have had a tremendous impact on science and technology. The accomplishments in the last decade in the fields of nuclear energy, missiles, and space travel would have been impossible without computers. The further out along the continuum of intelligent behavior we can push machine behavior the greater will be the future impact of computers. From the viewpoint of our technological competition with Russia research in artificial intelligence is extremely important. In the opinion of several qualified people, the Russians appear to be putting much more emphasis on research in artificial intelligence than are we.

Learning by a Computer

To me the most fascinating aspect of artificial intelligence is that of machine learning. Given a computer program which demonstrates a certain level of intelligence with respect to a certain problem, one would like to have the program benefit from repeated experiences with the problem in such a way as to display an increasingly higher level of intelligence. The human process of achieving a higher level of intelligence via repeated exposure to a problem is termed learning. Is it not possible for machines via their programs to exhibit learning capabilities?

The answer is "yes, it is possible." A computer, given an initial program, can display an increasingly higher level of intelligence through continuing interaction with a problem environment. A human being learns and creates on the basis of the program that his biological endowment gives him together with the changes in that program resulting from continuing interaction with his environment. Similarly, it is possible for a computer to exhibit learning capabilities via a program that in response to the task environment modifies itself in such a way as to enhance its future effectiveness.

Behavior More Intelligent than the Human Programmer's

Further, it is wrong to conclude that a computer can exhibit behavior no more intelligent than its human programmer and that he can accurately predict the behavior of his program. These conclusions presume that, because the programmer can write down as programs general prescriptions for adaptive behavior by the computer, he can comprehend the remote consequences of the program after the execution of millions of information-processing operations all influenced by the continuing interaction with the task environment.

A popular activity in computer circles these days is the construction of various models representing complex economic and military environments. Some of these are only one-sided, while many are two-sided or multi-sided models. However, virtually none of these models exhibit any learning qualities via self-adaptive behavior. The same degree of intelligence is demonstrated each time a model is used, without any learning by the model from previous experiences. When learning features are added to such models, their usefulness will be greatly enhanced.

Ability to Learn and Level of Intelligence

The ability of a computer program to learn is dependent upon the self-modification or self-adaptive behavior of the program during repeated experiences within the environment in which it is to learn. If, after each experience, the program is then able to make more correct decisions in some future situation, it may be said that the program has learned from each experience.

The level or degree of intelligence of a computer program may be judged from two different viewpoints. The first viewpoint would be a priori considerations of the information possessed by the program and the resulting capabilities of the program. The second viewpoint would be an evaluation of the performance of program.

If the learning procedure of a computer program is successful, a continuing higher level of intelligence should result. From the viewpoint of a priori considerations the program should possess a larger quantity or higher quality of information and be expected to demonstrate a greater capability as it learns. From the viewpoint of performance, the program should demonstrate greater proficiency at the end of some learning period than at the beginning of that time. For example, if after a period of learning, a chess-playing program is able to win 70% of its games against a given opponent in contrast to only 40% of the games at the beginning of the learning period, the program certainly must be considered to have learned and achieved a higher level of intelligence.

At this point in the development of artificial intelligence, three learning techniques seem to lend themselves to computer learning. These are rote learning, generalized learning, and heuristic learning.

Rote Learning

The most elementary of these learning techniques is rote learning. Here a computer program simply stores in memory each situation encountered and some pertinent information concerning that specific situation. For instance, the information might include a measure of desirability of reaching the specific situation and a measure of the expected success for various possible alternate courses of action. Each encounter with the specific situation would provide experience upon which to base modifications to these measures.

The checker-playing program of Dr. A. L. Samuel* utilizes a rote learning procedure whereby board positions, each with an associated scribe, are saved. To the extent that retrieving a board position and its associated score requires less time than calculating the score for that position, this procedure is useful. However, the usefulness of such a procedure would be greatly enhanced if the moves from the board position were each tagged with a measure of immediate or ultimate success associated with the move as the program played from that given position over the course of hundreds of games.

Generalized Learning

An obvious way to decrease the amount of storage needed to utilize past experience is to generalize on the basis of experience and to save only the generalizations. Of course, this should be a continuous process if it is to be truly effective, and it should involve several levels of abstraction.

A generalization procedure was incorporated by Dr. Samuel into his checker playing program with rather interesting results. The program with the generalization procedure but without rote learning has learned to play a good middle game, but its openings are apt to be weak and it has never learned to win an end game with two kings against one in a double corner. In contrast, the program with the rote learning procedure but not the generalized procedure soon learned to make strong opening moves and learned to play a good end game, but was always quite poor in the middle game. Finally, of course, Dr. Samuel combined the better features of the rote learning procedure with the generalization procedure.

Heuristic Learning

Another approach to machine learning is via heuristic methods. A heuristic method is a rule of thumb, strategy, simplification, or any other kind of method which drastically limits the search for the solution to a complex problem. Heuristics do not guarantee optimal solutions; in fact they do not guarantee any solution at all; a useful heuristic simply provides a solution which is good enough most of the time.

It is worthwhile to consider the distinction between a heuristic and an algorithm, although the distinction is a controversial one. Under one common definition an alogrithm is a decision procedure, perhaps of many iterations, which is guaranteed to produce a best solution. However, as stated above, by heuristic methods the best solution and indeed any or all solutions may be overlooked. The payoff in using heuristics comes from a greatly reduced search from among possible alternatives.

A heuristic program has been developed by H. Gelernter,** J. R. Hansen, and D. W. Loveland for solving Euclidean geometry problems. The program has found solutions to a large number of problems taken from high school textbooks and final examinations. For some of these, it is doubtful whether any but the brighest students could have produced a solution when granted the same amount of prior "training" afforded the program (i.e., the same vocabulary of geometric concepts and the same stock of previously proved theorems).

Appraisal of Techniques

It seems clear that rote learning, generalized learning, and heuristic learning should be used as complimentary techniques rather than alternative ones for a computer program which is to display highly intelligent behavior in response to repeated experiences with a complex problem environment.

This belief is based on the following two reasons. First of all, rote learning and generalized learning procedures are desirable for cataloging past experiences and the consequences of alternate courses of action taken in each situation. Heuristic learning procedures should be used to develop and evaluate possible sub-goals within the problem environment, to develop alternative courses of action, and to develop measures of successful or unsuccessful progress.

Secondly, it is quite possible that each type of learning procedure is best suited to a different aspect of a given problem. For instance, consider a chess learning program. Rote learning procedures are well suited to opening play which involves the initial development of the pieces from a standard starting position. Generalized learning is well suited to end game play involving certain generalized positions in which an optimal line of play, or at least a line of play, for winning or drawing is well determined and precisely known from past experience. Heuristic learning procedures are desirable for middle game play or for any position for which previous rote or generalized learning have not provided a basis for choosing the next move.

Thus, each of the three types of learning procedures is likely to be desirable for a computer program which is designed to solve a complex problem. Rote learning procedures should record selective specific situations together with a measure of the consequences of specific experienced alternative courses of action. In the foreseeable future at least, there are two limitations on rote learning, namely, the amount of accessible storage for such information and the time required

*See article by Dr. A. L. Samuel in *Computers and Thought,* edited by Edward Feigenbaum and Julian Feldman, McGraw-Hill, 1963.

**See article by H. Gelernter, J. R. Hansen, and D. W. Loveland, in *Computers and Thought,* edited by Edward Feigenbaum and Julian Feldman, McGraw-Hill, 1963.

to locate and retrieve a given bit of information. Schemes to reduce the amount of information saved from previous experience will partially overcome this limitation. For instance, the retention of information from a past experience may be made dependent on its frequency of use and hopefully, therefore, on its importance. Information which falls into disuse would then be purged and either simply "forgotten" or generalized and added to the generalized information saved from past experiences.

Generalized learning procedures should be used to generalize past situations and note the consequences of experienced alternative types of action. Also, the relative importance of certain factors in a problem environment may be studied by generalizing a particular situation into some overall appraisal and noting information related to the factors of interest. Learning the relative importance of a set of factors believed to be relevant in a checker position is the most significant feature of the checker-playing program of Dr. Samuel.

Heuristic learning procedures should be used to develop goals within the problem environment, to develop alternative courses of action for achieving these goals, and to develop methods by which to choose a particular course of action and measure the consequences. The most difficult of these tasks would seem to be the development of the goals which are important to achieve within the broader problem environment. While accomplishment of this task by a computer program may be far off in the future, the task of investigating the relative importance of goals suggested by students of the problem environment is much less formidable. This latter task has been accomplished in at least one program, that being the checker-playing program of Dr. Samuel. With respect to the development of alternative courses of action, the importance of using heuristic procedures is to limit drastically the number of alternatives to be considered in any depth. Finally, of course, the evaluation of a chosen course of action is a most important task if a computer program is to benefit from past experience.

Goal Determination

What are the goals of a learning process on the part of a computer program within a problem environment? The answer to this question depends upon the nature of the problem environment and the motivation or guidance given to the program.

The problem environment may lend itself to one principal goal or to multiple goals which may or may not be in conflict. For instance, the principal ultimate goal of a chess game is to checkmate the enemy king at any price other than the checkmate of one's own king first by the opponent. Or the commander of an invasion force may be told to gain control of certain territory regardless of the losses to his invasion force. Similarly, a computer program to learn within either of the environments would have one principal goal.

On the other hand, consider a computer program for a merchandising control system in which the purpose is to learn how to control the merchandising of goods in such a way that the dollar profits are maximized and the level of service is maximized. These two goals may or may not be in conflict. It may happen that, as the program learns ways to increase dollar profits, some or all of these ways result in or are a result of an increased level of service, and vice versa. If this is so, then the two goals are always, or at least sometimes, compatible and not in conflict. However, suppose that, as the program learns ways to increase dollar profits, all of these ways are at the expense of the level of service, and vice versa. Then, the only way in which the computer program can resolve these two conflicting goals is to be given the relative importance of one more dollar of profit to one more per cent of service.

For a computer program which is to learn within a complex environment the further guidance beyond the principal goal or weighted parallel goals depends on the information one desires the program to possess initially and the information one wishes the program to learn for itself. For instance, a chess-playing program might be given only the rules of the game and the principal goal of winning games by checkmating the enemy king. On the other hand, subgoals which are known or believed to be pertinent with respect to attaining the principal goal may be given to the program. A set of subgoals might be material advantage, control of the center, mobility of pieces, and king safety. Assuming that these goals are all considered important throughout the game, they are then parallel sub-goals. A relative importance for each may or may not be given to the program. If relative importances are given, the computer program may be expected to modify these as a result of its learning.

In contrast to parallel sub-goals a program might be given serial sub-goals which it should strive to accomplish in a specific order or which it should investigate with respect to different orders of accomplishment. For the chess-playing program such a set of serial sub-goals might be pawn control of the center, development of king side pieces, development of the queen side pieces, gain of a material advantage, and assault upon the enemy king.

Goal Seeking

In seeking to achieve a principal goal or a sub-goal of a complex problem there may be only a few decisions required, or there may be a great many required. If a computer program is to learn from each decision and the resulting consequences, it should have a way of evaluating the result of each decision. This immediately raises the question of whether or not there is a measurable payoff associated with each decision.

Consider the problem of playing Blackjack as one of the players against the dealer. For the most part, a player has only one type of decision, that is, to request another card from the deck or not to request another card. If he requests a card, he then has the decision to make again unless his card total exceeds twenty-one. However, each decision is practically independent of the result of previous decisions on the same hand. Furthermore, and even more important, each decision may be evaluated in terms of not exceeding twenty-one when asking for another card and in terms of success against the dealer when deciding not to ask for any more cards. Usually only one or two decisions are required by the player before he goes over twenty-one or is satisfied with his holding. The dealer then plays his hand and the payoff to each of the players is known. Thus, only a very few relatively independent decisions are required of a player before there is a payoff.

On the other hand, consider the problem of playing chess. Some decisions may result in an immediate payoff, that is, a material or positional gain within one or two moves. However, in a closely contested game, a significant advantage may not be achieved for twenty or thirty moves by each player. This advantage is the payoff which is the net result of the moves by both players up to that point. The difficulty lies in associating a payoff with the single moves of each player. The player who has arrived at the less desirable position would certainly like to know which of his moves was the initial cause of his inferior position.

A computer program which learns will also have the problem of associating a payoff with each decision in order to judge the relative merit of each decision. If there is no immediate payoff as a result of a course of action, then measures must be developed by which to assess the position or progress toward a goal after each decision is made and its consequences are known.

Situation Recognition

When facing a new situation, if one is to benefit from past experience, one must relate the new situation to a specific or similar one in the past. If one has previously faced the identical situation, a course of action taken before may be taken again or a new course of action may be taken. Which of these to do depends on the past experience with the previous course of action, the desire for future experience with that course of action, and the desire for experience with new courses of action.

If one is not facing a situation identical to one from past experience, one may be able to relate the new situation to similar situations in the past. A type of action taken before may be taken again, perhaps even an identical course of action, or a new type of action may be taken. Here again, which to do depends on past experience with previous courses of action, the desire for further experience with certain types of action, and the desire for experience with new types of action.

A computer program which is to utilize the experience from specific past situations and courses of action, when placed in a given situation, must recognize an exact agreement with a previous situation or must recognize similarities between the present situation and previous ones. It is interesting to note that exact agreement with a previous situation is not necessarily more desirable than merely similarity to previous situations. Consider a chess-playing program which has learned to play as well as our best human players, and suppose that an end game situation arises with a king and rook against the opponent's king and queen knight's pawn. The program will most likely have learned a best strategy for winning in this position though it may never have faced the same exact position, whereas the program will undoubtedly be less sure of the best strategy for winning in various frequently encountered opening positions.

All these considerations have a direct bearing on games to represent warfare.

The Development of War Games

The idea of using a game to represent warfare has existed for many centuries. The game of checkers dates back to ancient Egypt. Hundreds of years later chess appeared in Iraq in the form of a Hindu battle game called "Chaturanga." The game was played on a board, a highly stylized terrain map, using various pieces to represent the arms of the service then in existence: elephants, horses, chariots, and foot soldiers. It was played by four persons with the effects of the selected moves determined by dice. This early version of chess is considered the oldest form of war game.

Little is known about war games during the Middle Ages; there are no recorded developments of games for the simulation of operations or combat other than modifications of the game of chess. During the sixteenth century many games were devised not too different from chess, but only meager information exists about them.

During the seventeenth, eighteenth and nineteenth centuries many elaborate military games were developed in Europe, principally by the Germans. The type and number of pieces, the type and size of the board or map, and the representation of terrain were the principal elements and differed from game to game. Perhaps the first significant advance was made by Von Reissurtz, the Prussian War Counselor at Breslau, who in 1811 transferred his war game from a chess board to terrain modeled in sand to a scale of 1:2373. This permitted more realistic maneuvering of troops.

Prussian War Games

The honor of originating the war game as we recognize it today is credited to Von Reissurtz, Jr., who acquired his father's interest in the game. As a first lieutenant in the Prussian Guard Artillery, he conceived the idea of adapting the game to actual military operations, and in 1824 transferred the game to realistic maplike charts to a scale of 1:8000. With the assistance of other officers, Von Reissurtz, Jr., framed an elaborate system of rules which were published in Berlin in 1824 in a work entitled "Instructions for the Representation of Tactical Maneuvers under the Guise of a War Game." Von Meffling, then chief of the German General Staff, was highly impressed by a demonstration of the game and formally recommended its use to the Prussian Army; each regiment was given a set. Lt. Von Reissurtz was directed to supervise the preparation and construction of the maps.

After the Franco-Prussian War of 1870 in which the Germans gamed various war campaign plans, other European countries began to take a serious interest in the use of war games. The military profession in England, Austria-Hungary, Italy, France, Russia, Turkey, and Japan prescribed regular playing of war games. For instance, the Japanese War college emphasized the war game in its courses of instruction. From a practical viewpoint, it is felt that the successes of the Japanese Army in the Russo-Japanese War of 1904 can be attributed to the training received in playing the games.

The Germans, however, continued to make the greatest use of war games during the period from the early twentieth century through World War II. Although undergoing many transformations to meet changing needs and subject to attack from many sources, war games retained their place in military training. Real operational plans on a vast scale were often played in the war games. At the outset of World War I the Von Schlieffen Plan was formed and evaluated via a war game. This plan almost won the war for them at the outset. Later in the war the Germans rehearsed the spring offensive of 1918 by means of a strategic war game; this game accurately indicated the slight chance of success. In World War II the initial campaigns against France and Russia were thoroughly rehearsed with spectacular success; in contrast, the early campaigns against Poland were not rehearsed and were much less successful. On another occasion a rehearsal of certain defensive measures in expectation of an American attack was in progress when, in fact, the attack was launched by the Americans. The German commander ordered that the game be continued, using the actual reports from the front as input information, and basing the decisions made on the game situation. This was the Ardennes battle on November 2, 1944. The Germans also gamed operation SEALION, the proposed invasion of England.

Japanese War Games

In 1940 Japan established the Total War Research Institute at which personnel from the various military services and the government gamed Japan's future courses of action, both military and diplomatic. These games resulted in detailed military and economic plans which were actually put into effect on December 8, 1941. In August, 1941, further war games were conducted at the War College in Tokyo. These games emphasized naval operations and studied the details of a surprise raid on Pearl Harbor. They also resulted in a carefully worked out schedule for occupying Malaya, Burma, the Dutch East Indies, the Philippines, the Solomons, and the Central Pacific Islands. These games were essentially three-sided exercises with teams of players representing Japan, England, and the United States.

United States War Games

War games appeared in the United States early in the nineteenth century. These games were based on the war games developed in the European countries. In the early twentieth century a considerable amount of gaming was conducted at the U.S. service schools such as Fort Leavenworth, the Command and General Staff College, and the Army and Naval War Colleges. Such games were played primarily for training purposes in conjunction with course work and evolved no really improved methods or techniques over those developed by the Germans.

It was not until World War II that the United States forces made extensive use of war games for investigating and rehearsing operational plans. In particular, extensive gaming went into the preparation for the D-Day invasion of Normandy. In more recent times the Bay of Pigs operation in Cuba was war-gamed. Today, war games are playing an important part in developing military doctrine and strategy.

A rather unique gaming facility exists at the Naval War College at Newport, Rhode Island. This is the Navy Electronic Simulation (NEWS) game, consisting essentially of an array of analog computers that are used to simulate the mobility, fire power, and intelligence needed by two teams of naval officers in mock battle with each other. The movements of ships are plotted on large screens by optical projectors controlled by navigational computers.

A Learning Program for Playing a War Game

A computer program with learning capabilities for playing a war game could be developed. Such a program would be expected to benefit from previous game experiences and thereby display an increasingly higher level of intelligence toward the war game environment.

The environment of the model should be a two or more sided game. If the model is only one-sided, the consequences of a particular decision are deterministic in accordance with the structured behavior of the environment represented by the model.

The computer program should be able to operate in two different modes. In the first mode the program should be able to act as one of the players against human opposition. Two purposes would be served by running the program in this mode: first of all, the performance of the computer program against skillful players would provide a measure of its current intelligence and of its learning over a period of time; secondly, this mode would provide training opportunities for human players and would permit the gaming of specific operational plans against the computer program.

In the second mode of operation the program would play each side of the game, independently acting as each player concerned. The use of complete internal games would greatly speed up the learning process of the computer program. Also, different versions of the program might be used when acting as different players. For instance, the version with learning procedures could act as one player, while a version without these procedures could act as the other player or players. The hopefully superior behavior of the version with learning procedures would be a measure of the effectiveness of these procedures.

The computer program could be used in yet another manner which is somewhat related to both modes discussed above. Since the computer program must have a means for evaluating alternative choices of action, a chosen situation derived from a war game (or specially constructed) could be given to several different human players for their judgments as to the best choice or choices. These selections could then be evaluated by the computer program, which could indicate the merits and shortcomings of the player choices.

Choice of War Game for a Learning Program

What type of war game should be chosen for which to develop a computer program with learning capabilities? One alternative is to develop such a program for one of the presently existing war games. The present state of war gaming tends to distinguish between tactical and logistical games, that is, in a particular game either the tactical play or the logistical play is emphasized. For instance, at the Research Analysis Corporation the THEATERSPIEL and TACSPIEL war games emphasize the play of tactical elements, while the recent NISKANEN game for the Secretary of Defense emphasized the play of logistical elements.

A second alternative is to develop a computer program for playing and learning within the framework of a new game. It would be interesting to develop a war game in which the tactical and logistical elements could be played in varying degrees of detail. For example, the tactical play might take place at the level now played in THEATERSPIEL or at the level now played in TACSPIEL, while the logistical play could likewise take place at either of these levels. Within one game the human players on one or both sides could vary the level of play, with the computer program playing any details below the level of human play. Thus, at any time, orders for subordinate units could be generated by the computer program from the orders given by the players for higher level units. This ability has been avidly desired by present war gamers.

One obvious possibility for consideration would be to incorporate the present or modified versions of THEATERSPIEL, TACSPIEL, and one of the logistics games into a comprehensive logistical-tactical game. Another possibility would be to incorporate the present or a modified version of Quick Gaming and one of the logistics games into a similarly comprehensive game.

To date, the principal difficulty with combining tactical and logistical play has been the time resolution problem. The time represented by one cycle of play in a tactical game is usually in terms of hours or minutes whereas the time represented by one cycle of play in a logistical game is usually in terms of days. For instance, THEATERSPIEL is played in 24-hour cycles, and a current TACSPIEL game is being played in 6-hour cycles with 30-minute sub-cycles, whereas the cycle of play in the recent logistics games has been 10-15 days. The resulting problem is that for human players to play a game long enough for the realistic study of logistical doctrine is too time consuming.

The existence of a computer program for playing a comprehensive tactical-logistical game would, quite independent of any learning capabilities of the program, solve the above problem concerning the time resolution of tactical and logistical play. Since for portions of the game the tactical maneuvers could be played by the computer program with only general guidance by the human tactical players, it would be possible to play the tactical elements for several logistical cycles in a reasonable amount of time.

Learning by a Program Playing Bridge

Another environment for which it would be desirable to develop a computer learning program is the game of bridge, particularly with respect to declarer's play of the hand and the defenders' defensive play upon the completion of the bidding. Such a program would be expected to play a continually improving game of bridge.

Intellectual pastimes, such as bridge, chess, or checkers, are extremely convenient vehicles for studying and developing learning procedures. The objectives of the game are well defined, the rules are likewise defined, and there is a large background of knowledge concerning the game against which the computer's learning progress can be tested.

Each of the above mentioned games is familiar to a large number of people to whom the behavior of a computer program for playing the game would be understandable. Furthermore, the ability to have the program play against human opposition adds spice to the development of learning procedures and provides a convincing means for demonstrating the learning progress of the program.

Bridge vs. a Military War Game

All the games mentioned above represent less complex environments than real military environments, while at the same time involving matters of strategy, tactics, intelligence, and logistics. Bridge, it seems, exhibits these four activities to a greater extent than chess or checkers, while at the same time it is equally well suited to the development of learning procedures. Following is a brief discussion of the strategic, tactical, intelligence and logistic activities involved in the play of a bridge hand.

Strategy

An expert declarer plans a grand strategy for the entire play of the hand. The strategy may have several variations or substrategies to provide against alternative situations which may develop during the play of the hand. A computer program should do the same, and the strategy and substrategies developed by the program for playing a given hand will reflect the level of intelligence of the program.

This development of a grand strategy is similar to the development of a grand strategy in a real military environment. In such an environment each military commander must decide on an overall strategy which he believes is most likely to achieve his objectives.

This procedure is not carried out by the players of a chess or checker game at the outset of a game. A player simply elects certain opening moves which he believes will lead to favorable positions or positions unfamiliar to his opponent.

Bridge, therefore, is better suited than chess or checkers to the development of a grand strategy for the entire play of the hand. For instance, typical strategies for the declarer are establishing a suit, cross-ruffing, and squeezing or end-playing a defender. The defenders, of course, attempt to ascertain what strategy the declarer is following and do their best to develop counter strategies to foil the declarer's plans.

Tactics

Once the declarer has planned his grand strategy, he must decide on his tactical play, that is, the specific way of playing the particular card combinations of the given hand to achieve goals within the grand strategy. Tactical maneuvers available to the declarer include cashing a high card, ruffing a card, finessing, unblocking, and playing a suit in such a way as to keep one of the defenders from gaining the lead.

These tactical maneuvers with respect to each of the four suits correspond to tactical maneuvers in four situations within a large military battle environment. Just as in a real military environment each side may possess a superiority of forces in certain situations within the enviroment, in a bridge hand the superiority of strength in a given suit may belong to one side or the other.

The defenders, of course, attempt to foil declarer's tactical plays by the manner in which they play their cards.

Intelligence

In the game of bridge no player possesses complete information concerning the cards held by the other players until the end of each deal. This means that the decisions of bidding and play must be made on the basis of both the known circumstances plus the assumed holdings of the other players on the basis of distributional probabilities and the actions of the other players. This situation has its parallel in military warfare, in which a military commander bases his decisions in situations of incomplete information upon probabilities from past experience and upon the present actions of the enemy.

Just as in military warfare deception is a most important feature of military operations, in bridge the expert bridge player will often resort to deceptive measures intended to mislead his opponent. Therefore, the problem of interpreting an opponent's action is a very real problem for each player, just as it is for each of the opposing military commanders in a real military environment.

From the above viewpoint, the games of chess and checkers bear much less resemblance to military warfare than does bridge because in these games each player has complete information regarding the forces of his opponent.

Logistics

Logistics enters into the game of bridge from the declarer's viewpoint when he assesses the number of entries in his hand and in the dummy. The number of entries may limit the execution of all of the tactical plays the declarer would like to carry out. Similarly, in military warfare a commander's tactical maneuvers depend upon adequate logistical support, and the available logistical capability may limit his desired operations.

The defenders are concerned with communication between their two hands. The effectiveness of their defensive play will often depend upon maintaining lines of communication between their hands.

Both the declarer and the defenders, of course, attempt to destroy the other side's lines of communication. This destruction takes the form of forcing the other side to play cards which are entries before it is useful to use the entry. In military warfare the analogy is the physical destruction or damage to the enemy logistical assets.

There is good evidence that many, if not all, of the learning procedures developed for the environment of bridge would be similar to learning procedures within the environment of a war game. As has been pointed out, both the game of bridge and a comprehensive war game involve matters of strategy, tactics, intelligence, and logistics. Perhaps, however, more rapid progress could be made in the development of learning procedures for the game of bridge than for a comprehensive war game. The overall environment is less complex, which would facilitate the development of a program to play at some initial level of intelligence. This ability is a prerequisite to the development of procedures by which the program can achieve a continually higher level of intelligence.

Bibliography

1. *Beat the Dealer,* Edward O. Thorp, Blaisdell Publishing Co., New York, 1962.
2. *Computers and Thought,* Edited by Edward Feigenbaum and Julian Feldman, McGraw-Hill Inc., New York, 1963.
3. *Contract Bridge: The Play of the Cards,* Fred L. Karpin, Bridge Quarterly Publishing Co., Chestnut Hill, Mass., 1958.
4. *Master Play,* Terence Reese, Eaton Press, Watertown, Mass., 1961.
5. *Modern Chess Strategy,* Edward Lasker, David McKay Co., Philadelphia, 1945.
6. *Psychological Strategy in Contract Bridge,* Fred L. Karpin, Harper & Brothers, New York, 1960.
7. *Scarne's Complete Guide to Gambling,* John Scarne, Simon and Schuster, New York, 1961.
8. "A Survey of Historical Developments in War Games," John P. Young, Operations Research Office of Johns Hopkins University, April 1960.
9. "The UNIVAC Plays Bridge," Thomas A. Throop in *Computers and Automation,* March, 1962.

WORLD REPORT — GREAT BRITAIN

British computer builders are in a state alternating between ill-suppressed fury and cynical resignation at what they consider to be one of the most crass examples of official bumbledom yet.

For the best part of two years, the Prime Minister, Harold Wilson, has been telling everyone that the Labour Party has saved the British computer industry. When the former Minister of Technology, Mr. Frank Cousins, had cause to mention the topic, he himself was the saviour, not the Party.

Simultaneously with all this great rescue operation, the UK's Ministry of Defence had a committee on computer needs sitting, and after something like 26 months of deliberations it has issued its specifications.

These have been doled out to the British builders, and if they had not protested, would have gone to everyone, including potentially powerful competitors from the United States.

There appears to be a requirement for around 1,000 computers, all expected to be miniaturized or sub-miniaturized units ranging from gunnery controllers to aircraft attack planning centers. Something like 40 separate machines are described, it is understood; though these could no doubt be whittled down to a range of five or six.

All this should be manna in the desert to the builders here who have had a rather lean time in military business recently. But it is not. It is said that not only do the specifications use IBM terminology throughout, but also propose IBM design philosophy. At one fell swoop, therefore, it looks as if the British designers — who are nonetheless good enough to win a development contract for the U.S. Navy's Corsair — will have to abandon their projects and start from scratch, although they have already achieved some excellent results with fully integrated microcircuitry developed with British Government money and under the prime requirement that they should be suitable for automated production.

Add to all this the need to develop completely different software and the comment from the Ministry that they may, if they wish, take a U.S. license, and there would seem to be some justification for irritation.

But this is not all. Most of the miniaturized computer projects now being completed or extended are funded in one way or another by the Ministry of Technology. Moreover this Ministry's own computer experts are drafting, with the manufacturers, plans for three types of machines to meet a mass-production requirement.

The idea is to turn them out at a rate of 500 a year initially for use in administration, schools, by the military, science, and business, as well as in manufacturing plants.

It is expected that specifications for the three little machines in this range will be available by the start of November. But it is already known that they will be very different from those dreamt up by the Defence Committee although a leading Technology computer expert sat on it.

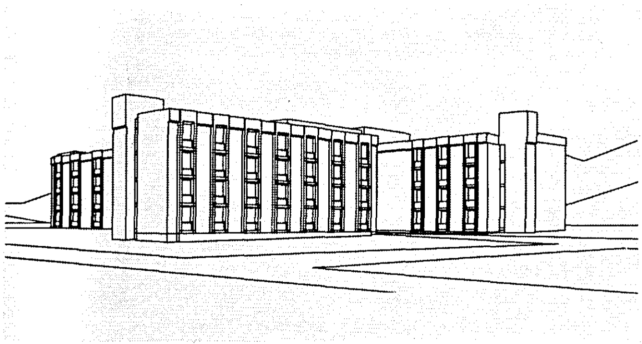
The only justification seems to be standardization within NATO and the carrot of possible sales to NATO countries. But after the disappointments of the past few years when British tanks, planes, guns, rifles, etc. have failed to secure contracts within NATO, this argument no longer carries any conviction.

It is going to take quite a lot of talking to persuade the computer men here to put up their money for the needed design studies. If the whole idea behind the operation has been to whittle Elliott-Automation, Ferranti, Marconi, and Plessey Automation down to just two companies there could hardly have been a more ham-fisted way of going about the task, even if the Government sees this as a prerequisite for their ultimate survival.

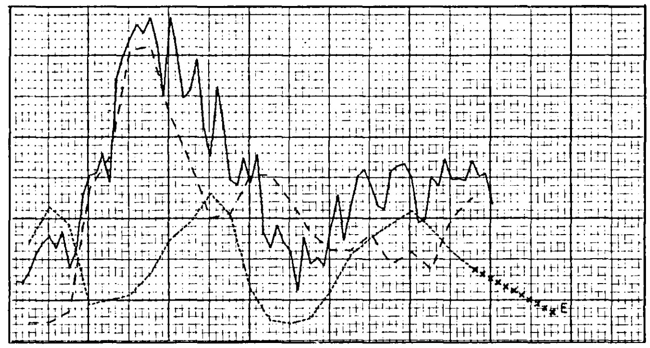
Ted Schoeters

Ted Schoeters
Stanmore
Middlesex
England

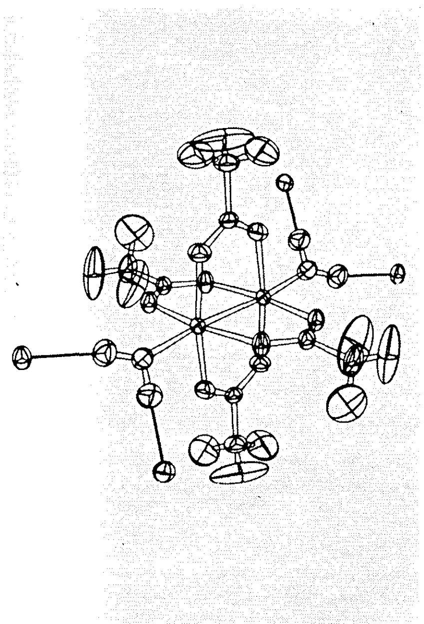
Would you believe a CalComp plotter and any computer can draw pictures like these in seconds?



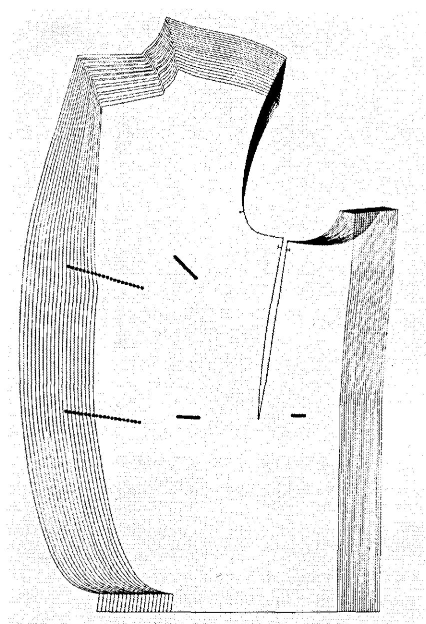
a perspective sketch of your new plant



statistical trend charts



molecular structure diagrams



apparel patterns, graded for sizes

and even the Mona Lisa

it can

Call or write Dept. A11, California Computer Products, Inc., 305 Muller, Anaheim, California 92803. Phone (714) 774-9141.

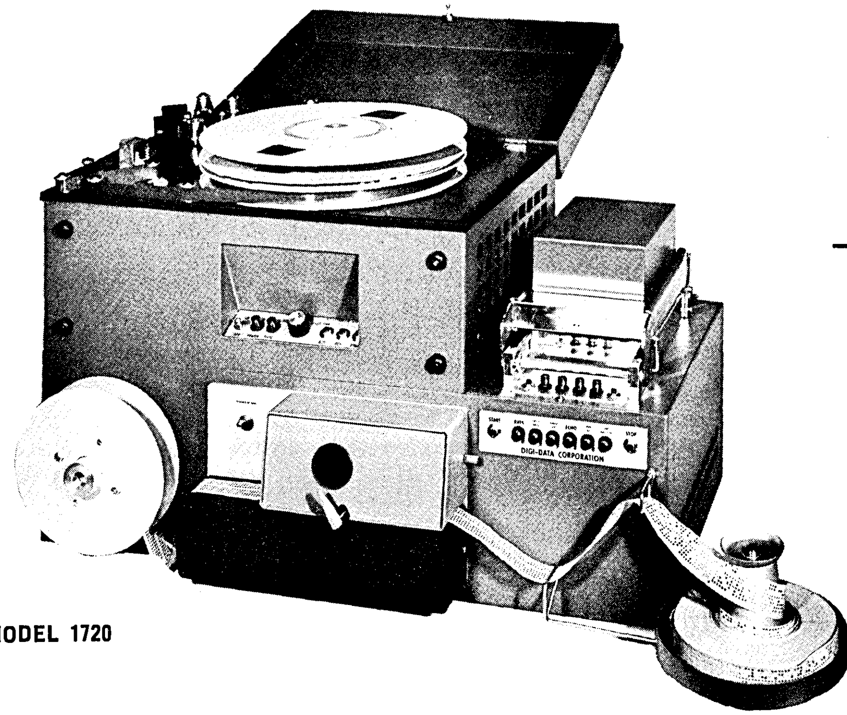
CALCOMP

Standard of the Plotting Industry

Designate No. 7 on Readers Service Card

(Talented Engineers and Programmers required — right now.)

SOME THINGS ARE BETTER DONE OFF LINE —



MODEL 1720

— Paper Tape to Magnetic Tape Conversion for example;

- Virtually any paper tape reader will limit the speed of your computer, but now your computer can run at full speed.
- The Model 1720 uses center tape unwind for simplest possible tape loading and handling.
- Performs error and validity checks.
- Low cost.
- Minimizes computer scheduling problems.
- Broad programming capability handles virtually all code conversion or format conversion requirements.
- Minimal space required; any table or desk will serve the purpose.
- Easy on tape—mangled tapes are unheard of.
- Nationwide service.

— Low-cost Data Transmission;

In addition to our line of converters, Digi-Data Corporation manufactures card and paper tape Data-Phone® transmission units such as the Model 2120 Magnetic Tape Receiver and the 2020 Card Transmitter shown here.

DIGI-DATA CORPORATION

DIGITAL STEPPING RECORDERS ■ DIGITAL DATA HANDLING EQUIPMENT

4315 Baltimore Avenue • Bladensburg, Maryland 20710 • Telephone (301) 277-9378

Circle No. 23 on Readers Service Card

ACROSS THE EDITOR'S DESK

Computing and Data Processing Newsletter

TABLE OF CONTENTS

APPLICATIONS

COMPUTER TO SPEED AID FOR NEW JERSEY'S UNEMPLOYED

The New Jersey Labor Department has hired a large-scale RCA Spectra 70/45 computer and 37 remote terminals to speed the processing of unemployment information and claims. The computer will provide the state's jobless "with faster, more efficient service than was ever before possible," according to Raymond Male, Commissioner of Labor and Industry. The computer, to be installed in the Department of Labor and Industry building in Trenton, will have remote terminals at each of the 37 local unemployment offices throughout the state which will be used to feed information to the computer and also to prepare checks.

When a client appears at a local office to collect an unemployment check, an identification card containing his social security number will be placed in a slot. The information will be transmitted by the office's remote terminal over telephone lines to the computer in Trenton which will electronically verify his record and tabulate his benefits. This information then will be relayed back to the local office and a check will be printed on-the-spot. The entire procedure will take 30 seconds.

Unemployment insurance currently is handled by a punch card procedure. Requests are made and cleared at local offices, information is mailed to Trenton, and punch cards returned by mail. The computer will eliminate mailing delays, duplicate files and punch cards, and will make it impossible to overdraw an account or collect unemployment compensation illegally. Computerization also will make it possible to collect an insurance check at any unemployment office in the state rather than being restricted to one local office as is now the case.

"Eventually," Mr. Male added, "we should be able to use the computer to match unemployed workers with unfilled jobs anywhere in New Jersey. As other states apply computers to their own operations, it is conceivable that a nationwide hookup could be established that would make possible an exchange of this type of information between states."

COMPUTER MASTERMINDING TEXTILE DYEING PROCESS

A computer-directed control system is "masterminding" the dyeing of synthetic fabrics at Lyman Printing & Finishing Co. in Lyman, S.C. Using formulas and procedures stored in its "memory", the computer directs the advanced control system that monitors every phase of the complex dyeing process at this textile finishing plant. It tells operators when dyes and chemicals are to be piped into the becks (tanks) in which the fabrics are dyed and when to cut a patch (sample) from the cloth for a color check. It opens and closes valves, automatically sequencing the filling, heating, cooling, pressurizing and emptying of becks, and even summarizes on a teleprinter what happened during the dyeing cycle.

Lyman Printing & Finishing Co. has disclosed that the unique computer control system, developed by Honeywell Inc. and described as the first ever applied to a textile production process, has been in operation since last February. William H. Grier, president of Lyman, a subsidiary of M. Lowenstein & Sons, Inc., said the system has "exceeded our expectations in achieving repeatability of dyeing procedures."

A Honeywell 610 system directs the continuous color and chemical blending of synthetic fabrics as these are dyed in both pressurized and atmospheric tanks. Pre-programmed dyeing procedures are stored in the computer's memory. The computer communicates with beck operators by means of display and acknowledgement systems, telling them when to perform a manual operation and refusing to proceed with the dyeing cycle until the task is completed. There is a manually operated backup control system that can assume the computer's role temporarily in an emergency.

While the 610 is the "mastermind", initiating and directing dyeing cycles, the control system also includes devices that enable the dyer to "talk" with the process and the process to "talk" with him. One device is a monitoring console used by the dyer to interrogate a beck as to what is happening at any point in the dyeing cycle. This same console enables the dyer to implement or develop new dyeing procedures without upsetting the production process. Another device provides status information on beck operation and provides a means of assigning a beck to a particular lot of cloth when it arrives in the dye-house.

Lyman and another Lowenstein subsidiary, Rock Hill Printing & Finishing Co., Rock Hill, S.C., process approximately one billion yards of fabrics annually for suiting, apparel piece goods, sheets and pillow cases, towels and industrial fabrics. These are sold under the Lowenstein, Wamsutta and Pacific labels.

AIR EXPRESS INAUGURATES COMPUTER TRACING IN BOSTON

Air Express, nationally known cargo service, is utilizing IBM computers to help speed tracing procedures for the thousands of different shipments that pass through the Air Express terminal at Logan Airport (Boston, Mass.) each day. Since the inception of the computer program on May 18, Logan Airport Air Express manager L. P. McArron estimates that customer questions about shipments can be answered accurately and completely in half the time it used to take.

Twice each day, all Air Express dispatch forms are sent to the computer room at R E A Express facilities in downtown Boston. For each shipment, a card is punched identifying the airline flight number, off-loading point, waybill number, number of pieces in the shipment and the weight of the shipment. Cards then are sorted automatically according to ascending waybill number. This information is printed out on sheets which are then sent back to the airport office before 8 a.m. the next morning. The computer prints out as many copies of the information as needed so that every telephone clerk at Logan will have his own personal record of every shipment sent through the terminal the previous day.

Prior to the new system, one copy of the Air Express dispatch form was retained at Logan for each shipment. Forms were arranged according to airlines and all clerks shared the one set of forms. This meant keeping a customer on the phone for an extended period of time before examining the forms another clerk was using to help another customer. When the customer calls today he simply gives the tracing clerk the waybill number and the clerk almost instantly can provide the necessary information from his own computer-printed record. Ultimately, it is expected that the computer system will be utilized in all major Air Express cities throughout the country.

COMPUTER ENGINEERED BELT CONVEYOR SYSTEMS

Litton Industries' Hewitt-Robins division has developed a computerized method which provides detailed engineering data for designing a total conveyor system. The computer system has almost infinite design flexibility permitting the customer or engineer to introduce his own specifications for individual components. While the minimum required data is capacity, density, and over-all geometry, the computer system can absorb as many requirements, restrictions, and specifications as the customer or engineer desires.

Any design factor can be specified by the customer or engineer to satisfy the requirements of special operating conditions. If, however, the code spaces for these options and special instructions are left blank, the computer will automatically select the most economical component that satisfies engineering requirements and computer standards. In addition to printing out a complete engineering analysis of each conveyor, the computer system also can provide individual and consolidated equipment bills of material.

According to Frank J. Tencza, Chief Engineer at Robins Engineers and Contractors of Hewitt-Robins, "one of the main advantages of the system's flexibility is the ability to permit standardization of components in the design of a large, multi-unit conveyor system. Standardization of components where possible simplifies spare parts requirements thus minimizing spare part inventories and permits economies through quantity purchasing. In this system, we can input the requirements for standardized components and wind up with the most economical standarized job at the lowest cost to the customer."

NEW CONTRACTS

FROM	TO	FOR	AMOUNT
Contra Costa County, Calif.	Cubic Corp., San Diego, Calif.	A lease-purchase contract for 40 Votronics vote counters and associated computer equipment with fully automated punched card output that will see initial use in the November general election	$1,188,400
Naval Ships Systems Command	Sperry Rand Corp., UNIVAC Defense Systems Div.	Production of six complete units, each including a 7x7x12 foot shelter, computer, buffer unit for communication with other elements of the Marine Tactical Data Systems (MIDS), and a modified UNIVAC 1532 input-output console	$4 million
AVCO Corporation	Sylvania Electric Products Inc., a GT&E subsidiary	Data processing equipment to detect sea launched ballistic missiles	$2.5 million
International Telephone and Telegraph Co.	Decision Control, Inc., Newport Beach, Calif.	An initial memory system order, both buffer and large capacity computer memory systems, to be used as main storage for large scale message switching computers in both government and commercial service	about $2 million

FROM	TO	FOR	AMOUNT
Hughes Aircraft Co., Los Angeles, Calif.	Control Data Corp., Minneapolis, Minn.	Phase II contract on the Phoenix Missile Fire Control Program which calls for delivery of five Control Data 5400-type microelectronic, airborne computers	over $2 million
U. S. Department of Agriculture, Farmers Home Administration	Burroughs Corporation	A B3500 computer system which will provide additional computer capacity for Department of Agriculture and other govt. agencies in St. Louis (Mo.) area where it will be installed in September 1967	$1½ million
Union Carbide Corp.'s Taft Chemical plant, Taft, La.	General Electric Process Computer Business Section	Large process computer complex, includes three GE/PAC 4050 computers and one GE/PAC 4060, with accompanying GE/MAC instrumentation	—
NASA's Ames Research Center, near Mountain View, Calif.	Computer Sciences Corp., El Segundo, Calif.	Continued operation of the telemetry processing station for Project Pioneer at the Center	$224,000
Air Force Materials Laboratory, Wright-Patterson AFB	Control Data Corp., Minneapolis, Minn.	Developmental work on analog/digital conversion equipment to be used in airborne data processing systems	$324,000
The Hospital Review and Planning Council of Southern New York, Inc.	Western Union, New York, N.Y.	A management consulting study of the feasibility of a computer-communications system which will provide information on hospital beds available for emergency cases in Brooklyn, N.Y.	—
National Aeronautics and Space Administration	B-R Data Systems, Inc., Silver Spring, Md.	Two contracts: one for installing and operating automated program management and information system for NASA's Office of Advanced Research and Technology (OART); the second covers ADP programming services at NASA Headquarters in support of the Position Management System	$193,000
Western Union, New York, N.Y.	Tally Corporation, Seattle, Wash.	Eighty high-speed data transmission terminals (Tally System 311) to be incorporated into the company's broadband service for domestic and international data transmission	$500,000
Humble Oil & Refining Co.	Bonner & Moore Associates, Inc., Houston, Texas	Design, development and implementation of a computerized system to schedule and control motor gasoline blending operations at Humble's Baton Rouge refinery	—
California Land Title Co.; Southern California Title Co.; Lawyers Title Insurance Corp.; and Stewart Title Guaranty Co.	Planning Research Corp., Los Angeles, Calif.	A 100%-accurate, computerized title search system — system will use an IBM System/360 Model 30	—
National Aeronautics and Space Administration	California Computer Products, Inc., Anaheim, Calif.	Flight readiness maintenance of Nimbus Weather Satellite subsystems and the operation of NASA ground stations at Valley Forge, Pa. and Vandenberg AFB, Calif.	$275,000
U. S. Department of Justice, Office of Law Assistance	Polytechnic Institute of Brooklyn, Brooklyn, N.Y.	Supporting research exploring ways in which a computer can foresee the effects of changes in police procedures and practices — seeking better methods of police protection in America's cities	$43,000
U. S. Department of the Army	Friden, Inc., San Leandro, Calif.	R&D contract for the production of advanced teleprinters, distributor transmitter, reperforator, teleprinter, and equipment control panels and related software	$828,877
Automatic Management Systems, Jackson, Miss.	Programmatics Inc., Los Angeles, Calif.	Development of a computerized automatic accounting system which will operate on an IBM 360	—

NEW INSTALLATIONS

AT	OF	FOR
County of Santa Clara, San Jose, Calif.	8000+ IBM Votomatic vote recorders valued at $1,347,000	Use in the November general election
Merchants Credit Association of San Diego (Calif.)	NCR 315 system	Instantaneous 'on-line' inquiry into individual credit histories
Computing Center, State University of New York at Albany	Control Data 3100 computing system	Research, administrative data processing, and curricular support for Computer Science courses

AT	OF	FOR
Liverpool, England	Plessey XL 9 computer	Computer-controlled traffic system; main purpose to keep traffic destined for the Mersey tunnel separate from the rest of the city's traffic
Ex-Cell-O Corporation, Detroit, Mich.	A second Control Data 3100 computer system	Use as major portion of an extensive, multi-computer management information system
Westinghouse Electric Co., Mansfield Data Processing Center, Mansfield, Ohio	IBM System/360 Model 30	Key element in developing a more advanced production control program
Commer Cars Limited, Dunstable, England	Two NCR Series 500 computers	Providing up-to-date "exception" reports on stock levels, in addition to producing visible ledger-card records for use of production control personnel
Amron Corporation, Waukesha, Wis.	IBM System/360 Model 20	Payroll; production, labor, purchasing and budget reporting areas; also programming many other systems in maintenance, inventory and production process areas
Burmeister & Wain, Copenhagen, Denmark	UNIVAC 1107 computer	An integrated data processing system including production planning, production follow-up, payroll, budget and statistical reports, and inventory control; also technical calculations involved in shipbuilding and in design and construction of diesel engines
Leeds College of Technology, England	ICT 1900 digital computer	Advanced full-time courses of computing methods; will also be used by other colleges in Leeds and eventually by some of the schools in the area
R. J. Schmidt & Associates, Louisville, Ky.	UNIVAC 9200 computer system	Processing accounts of a number of small business concerns and also for billing purposes
The National Underwriter Company, Cincinnati, Ohio	IBM System/360 Model 20	Subscription fulfillment and order processing for its 70 insurance publications in addition to printing over 200,000 address labels monthly; producing most of the accounting and sales reports associated with publishing
Berkshire Apparel Corp., Malden, Mass.	Honeywell 200 system	Broadening data gathering and management information capabilities; plans for sales forecasting and production and inventory control
Roper Public Opinion Research Center, Williams College, Williamstown, Mass.	RCA 301 system	Storage and recall of nearly 400 million answers to poll questions since 1936; experimental links are planned among four universities across the nation, giving scholars at widely separated locations direct access to a fund of social science information
The Toronto-Dominion Bank, Toronto, Ontario, Canada	NCR 315 system	Handling the banks growing volume in the Montreal area; two systems already are in operation at the Toronto data center
Mercury Motor Express, Inc., Tampa, Fla.	UNIVAC 9300 computer system	Revenue accounting, accounts receivable, interline billing, bank reconciliation, payrolls and accounts payable
Ruble Miller Associates, Duluth, Minn.	IBM 1130 computer system	Use in planning of various engineering, architectural, laboratory and water use projects
City of San Jose, Public Works Dept., San Jose, Calif.	IBM 1800 data acquisition and control system	Traffic light control, designing streets and highways and for keeping inventories and records of city maintenance equipment and street furniture
American Institute of Technology, Phoenix, Ariz.	Honeywell 120 computer system	Student instruction, including several from foreign countries and several who are blind; the school currently is working with Arizona's State Department of Rehabilitation for Non-Sighted
North Borneo Trading Co., Ltd., Jesselton, State of Sebah, Malaysia	NCR Series 500 computer	Inventory control of about 25,000 merchandise items, invoicing and billing, and a variety of management reports
First Camden National Bank and Trust Co., Camden, N.J.	RCA Spectra 70/45 computer	Initial use in processing of checking accounts, installment loans and First Camden savings bonds; later will process savings accounts, trust department records, payrolls for bank and commercial customers
ITT Data Services (div. of International Telephone and Telegraph Corp.), Paramus, N.J.	IBM System/360, Model 50	Expansion of the data processing system capabilities of the Eastern regional computer center
ITT Data Services (div. of International Telephone and Telegraph Corp.), El Segundo, Calif.	IBM System/360, Model 50	Expansion of the data processing system capabilities of the Western regional computer center
Dayton Malleable Iron Co., Dayton, Ohio	NCR Series 500 computer	A variety of accounting applications, particularly for payroll preparation; also will include manufacturing production control and tabulation of manpower requirements, and construction estimating and maintenance of equipment records
Buckeye Steel Castings Co., Columbus, Ohio	IBM System/360 Model 20	Accounting and statistical tasks and tighter management control over daily operations
Terry's of York, York, England	Honeywell Series 200 computer	Use in all areas of firm's data processing applications
Jefferson County Bank, Lakewood, Colo.	NCR 315 computer	Demand deposit, savings, installment loan and customer services

ORGANIZATION NEWS

CHICAGO GROUP FORMS RAILDATA CORPORATION

A $2.5 million dollar computer and communications complex is being established in Chicago to serve the railroad industry. The new organization is named RAILDATA Corporation. It will provide the railroad industry with a centralized electronic information processing system to record the whereabouts and other key factors regarding the nation's freight car fleet. Its system is referred to as the Car Information Clearing House (CINCH). CINCH is scheduled to be operating the first quarter of 1968.

RAILDATA Corporation will be a subsidiary of Ehlers, Maremont and Company, Inc., a Chicago-based consulting firm. Marvin W. Ehlers, Executive Vice President of Ehlers, Maremont and Company, Inc., will be the President of RAILDATA Corporation. Robert L. Bell, formerly Manager of Systems and Procedures for The Milwaukee Road and a 20-year veteran of the railroad industry will serve as Vice President and General Manager. John Kinsella, formerly with Canadian Pacific Railroad and Canadian National Railways will be Director of Systems and Programming.

BRANDON FORMS NEW DIVISION

A new division that will provide technical training and management education in data processing has been formed by Brandon Applied Systems, Inc., New York, N.Y. The new division, called the Brandon Systems Institute, will be headquartered in the Washington, D.C. office of Brandon Applied Systems. David F. Alison, formerly with C-E-I-R in Washington, has been named Director of the Institute.

For more than two years, Brandon Applied Systems, Inc. has conducted a regular curriculum of technical and management seminars in the United States and abroad to acquaint top management and data processing executives with the latest techniques for technical and economic evaluation of computer operations. In addition, the firm develops special in-plant training programs to meet special needs. Brandon Systems Institute will assume responsibility for these already established programs and will provide others as the need develops. (For more information, designate #41 on the Readers Service Card.)

COMPUTER REPLACED FAST AFTER INDIANA EXPLOSION

Critical computer operations came to an abrupt halt on Tuesday, August 23rd, at the Phelps Dodge Copper Products Corp., Fort Wayne, Ind., when the two-story office building exploded and a Honeywell 200 computer was totally destroyed.

On Friday evening, three days later, an emergency air shipment of a new Honeywell 200 computer was made from Honeywell's electronic data processing division in Boston, Mass. The system was up and running the following Monday morning, August 29, in a temporary facility, making it possible for Phelps Dodge to resume its data processing activities. Resumption of computer operations have been easier than might have been expected because most of the master business files kept on magnetic computer tapes were in a steel and concrete vault.

OPEN NEW ENGLAND OFFICE

Keystone Computer Associates, Inc., Willow Grove, Pa., recently have opened a branch office in Belmont, Mass. The New England Regional Office is headed by Salvatore A. Crisafulli who has held positions on both the sales and technical staffs of major manufacturers and users of computers, most recently with McDonnell Automation Center.

Keystone, a firm specializing in the areas of computer programming and systems design, operations research and system analysis, will offer its full complement of services through the new branch office.

McDONNELL COMPANY PURCHASES 25 PER CENT INTEREST IN CARS, INC.

McDonnell Company, St. Louis, Mo., has purchased a 25 per cent interest in Computerized Automotive Reporting Service, Inc., of Jacksonville, Fla., and will provide data processing services to a nationwide network for that firm. The announcement was made by John A. Williamson, President of CARS, Inc., and William R. Orthwein, Jr., chief executive officer of the McDonnell Automation Center.

CARS, Inc., founded in 1964, services automobile dealers from coast to coast with a computerized system which provides management with sales analyses, inventory control, accounting, customer follow-up and similar type reports on an overnight basis.

The announcement said that "the agreement between the two companies will combine the well-known business systems, engineering and computer capabilities of the McDonnell Automation Center with the experienced automobile dealer marketing organization of CARS, Inc."

NAME CHANGE ANNOUNCED

New Era Data Systems, Inc., New York, N.Y., has announced it has changed its name to Data Scan Incorporated. In announcing the name change, Chairman Edwin M. Bederson noted that it follows the recent acquisition of New Era Letter Co. and New Era Lithograph Co. by another firm. He explained that New Era Data Systems (founded in 1961) was at one time affiliated with these two companies. It was felt this was an opportune time to adopt a new name to emphasize that there was no longer any connection with them.

Data Scan Incorporated is a service organization specializing in electronic optical scanning operations, computerized direct mail, and the design and development of information systems and computer programs. It serves a broad range of customers in industry, finance and government.

HONEYWELL FORMS U.K. COMPUTER GROUP AS ARM OF U.S. DIVISION

Formation of a computer programming group in England has been announced by the electronic data processing division of Honeywell Inc. The new group will be situated in the Brentford headquarters of Honeywell Controls, Ltd., the corporation's United Kingdom subsidiary, and will develop "software" for Honeywell's worldwide computer operations.

"This move is not being made to establish a separate programming group solely for the benefit of the United Kingdom and Europe," C. W. Spangle, the EDP division's vice president and general manager, explained, "but to add to Honeywell's worldwide data processing capabilities the talents and experience of leading British programming people — without making it necessary for these people to leave home.....The new group will be meshed with our over-all software development program in whatever capacities required."

LITTON INDUSTRIES DIVISION $1 MILLION EXPANSION PROGRAM

A million-dollar expansion program for Litton Industries' Advanced Circuitry Division, including the establishment of a new West Coast facility, has been announced by Doyle T. Rickett, division vice president and general manager.

The West Coast plant (Van Nuys, Calif.) initially will be devoted to research and development of sophisticated circuitry, including multilayer circuits, and production of the more advanced and prototype models. Operations commenced last month and within one year 100 persons are expected to be employed.

Expansion of the division's main Springfield, Mo., plant includes an addition of new equipment which will double production capacity and include the capability to produce new products now in the development stage.

IBM PLANS NEW PLANT IN UNITED KINGDOM

IBM United Kingdom, Ltd., a subsidiary of the IBM World Trade Corporation, has announced plans to establish a second manufacturing facility in the United Kingdom. The new plant will be built at Havant, near Portsmouth. It will produce advanced computer memories.

IBM United Kingdom has had a manufacturing plant at Greenock, Scotland, since 1954. The Greenock facility produces a wide range of data processing equipment, including the IBM 1130 scientific computer.

IBM United Kingdom was established in 1951. The parent company, IBM World Trade Corporation, is the international subsidiary of International Business Machines Corporation and conducts IBM's business in 102 countries outside the U.S.

COMPUTING CENTERS

COMPUTER SHARING OFFERS ADVANTAGES OF LOW-COST EDP TO SMALL COMPANIES

Small businesses are discovering a new way to compete on equal terms with giant competitors. By sharing data processing facilities with other small users, they are gaining vital operational advantages without having to bear the entire cost of their own computers. This means that they can tool themselves like larger businesses and enjoy the same competitive edge.

Recently some of the small businesses of the nation, the rural electric and telephone cooperatives, have joined together to form their own shared computer system. Established by the EDP Division of the North Dakota Association of Rural Electric and Telephone Cooperatives, this "management information utility" is already providing data processing services for four rural cooperatives and is planning to add 30 to 40 more to the system in the immediate future. It is anticipated that this system will branch out to serve the neighboring five-state area and may eventually become part of a nationwide rural-cooperative data processing system.

For a start, the new system is handling only consumer billing. It is planned to soon add other accounting services as well as inventory control, continuous property records and engineering applications. At each of the four participating rural cooperatives a clerk prepares billing information in punched tape form, places the tape in the transmitter of a Bell System teletypewriter and then transmits it at 100 wpm via Teletypewriter Exchange Service (TWX) to the EDP center. As the tape is transmitted, the teletypewriter prints a page copy of the billing information for the company's records. At the shared computer center the billing information is received in both page and tape form by another teletypewriter. The tape is rewound and then processed by a Burroughs B-300 computer system and the information finally is stored on magnetic tape where it is immediately accessible.

With data communications linking the users to the processing center, there is no danger that the source document might be lost in transit for it always remains at the user's office. In addition, the participating cooperative and the center can readily communicate with each other by teletypewriter to make changes or convey special instructions.

WESTERN GEOPHYSICAL OPENS LONDON FACILITY

Litton Industries' Western Geophysical Division has opened a facility in London for producing cross-sections of the earth's crust from digital seismic data recorded by seismic crews on both land and sea. Called the London Digital Service Center, the new facility is in charge of Leo J. Dunn supervisor of all European activities for the company.

Modern, high-speed digital computers and realted equipment will process seismic data gathered by marine crews in the North Sea, Persian Gulf, Mediterranean, and other parts of Europe. These crews compile data by creating a series of minute earth-tremors and obtaining a magnetic tape recording of the vibrations returning from a section of the Earth. Magnetic tapes from numerous areas are delivered to the service center, where they are converted into cross sections and maps for use by companies searching for oil.

A similar data processing center is maintained in Shreveport, La.

BRITISH COMPUTER SERVICE FIRM OPENS SATELLITE CENTER

Computer Services (Birmingham) Ltd., operators of one of the largest data processing centers in Europe at Birmingham in the British Midlands, has broadened its services to business and industry in the United Kingdom by opening a Satellite Computer Center in central London. The new Center provides clients in London and neighboring counties with access to a Sperry Rand UNIVAC 1107 Computer System at the Birmingham facility via the Datel system — a special high-speed telephone data link operated by Britain's General Post Office Authority.

Among other activities, Computer Services, known as CSB, currently is engaged in an educational program to disseminate information on computer usage and technology to the management of British industrial and business concerns.

EDUCATION NEWS

NC CORRESPONDENCE COURSE

An important development in the area of numerical control education has been revealed with the success of the Numerical Control Society's (Princeton, N.J.) Basic NC Correspondence. The popularity of the course, introduced this year at a modest cost of $25 only, demonstrates the pressing demand for training of beginners and review for professionals in the NC field.

John A. Moorhead Associates (JAMA), the widely-known NC training consultants who are conducting the course, report that many of the courses have already been completed, no doubt due to the prompt and personal instruction and the twenty-four hour return of worksheets and tests to students.

The NCS Basic NC Correspondence Course consists of a 90 page manual, eleven worksheets, a mid-course review, and a final test. It has been carefully designed and tested to be understandable by anyone who has been associated with the metalworking industry.

Anyone may register by sending a check or money order to NCS at 44 Nassau St., Princeton, N.J. 08540. A brochure describing the course in detail is available from the same address.

FJCC EDUCATION PROGRAM

More than 1200 junior college and high school students from the Bay Area will take part in special education programs planned in connection with the 1966 Fall Joint Computer Conference in San Francisco, November 8-10. According to R. J. Andrews of the IBM Corp., San Jose, chairman of the education program, there will be three programs which last all day, two for high school students and one for junior college students. All three sessions, entitled "Computers in Your Vocation," include an introduction to computers by R. S. Waller of UNIVAC, San Francisco; a demonstration by R. H. Mattern, Jr. of IBM Corp., Los Gatos, of a computer in New York connected to a control center in San Francisco to show how such a linking can be used in classroom teaching; and a tour of the exhibit area where the students will see over 100 exhibits of the latest equipment.

Specifically for students from 12 junior colleges in Northern California, E. F. Wong of Honeywell Electronic Data Processing, Los Angeles, will give a session on the use of computers in space activities. The students also will hear a review of the importance of computers and automation to society by R. B. Forest, editor of "Datamation."

For the high school students, a demonstration on the role of analog and hybrid computers in education has been prepared by J. M. Evans of EAI Analog Computer Educational Users Group, Los Angeles. Mr. Wong also has prepared a session for high school students suggesting how they may prepare themselves now for anticipated changes in society expected from computers and automation.

C. C. Prugh of California State Employment Service, San Francisco, will introduce requirements, opportunities and salaries in the data-processing field. Later the students will be divided into groups for briefing on career opportunities in specific areas of computer technology.

FIRST COMPUTERIZED MEDICAL SCHOOL COURSE

The nation's first computerized medical school course recently was unveiled by the University of Oklahoma Medical Center. Dr. Edward Brandt, director of the university's Medical Center Computer Facility, said, "The first course to be taught using computer help is Medical Backgrounds, a required course for graduate student enrollees in preventive medicine and public health." The course, taught by Dr. Thomas Lynn, continues to be a two-hour course. After each two lecture hours, however, students spend one hour studying the appropriate computer assisted instruction (CAI) material previously put into the computer.

CAI employs standard IBM equipment and an IBM symbolic programming language, Coursewriter. This language makes it easier for educators to put course materials into computers. Medical Backgrounds, a survey course in medical terms and procedures, is the first Oklahoma CAI attempt. A refinement of CAI technique permitted Dr. Lynn to put his course in an IBM 1401 indirectly, using dictation equipment and a highly-trained typist.

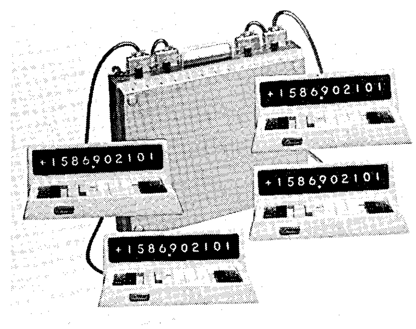
Dr. Brandt said, "Our 1401 simultaneously instructs four students sitting at typewriter-like IBM 1050 terminals. Eventually we will have terminals for as many students as our curriculum and enrollment demand. Each station will have access to any of the courses within the computer. We soon will have a larger-capacity computer and currently are transcribing two more courses for CAI, with three more being planned."

NEW PRODUCTS

Digital

"TIME SHARING" SYSTEM FOR ELECTRONIC CALCULATORS

Wang Laboratories, Tewksbury, Mass., has announced the availability of a new calculator system in which as many as four relatively low cost keyboard/display console units may be operated simultaneously from a single control electronics device. The basic instrument used in the unique multiple-console system is the Wang Model 320, an advanced solid-state scientific calculator. The 320 console is a



small, lightweight desk-top device providing three separate sets of input keys for a variety of operations (including single-key computation of squares, square roots and natural logarithms), together with a panel on which input and output figures are displayed instantly in large, lighted numerals 5/8" in height.

Now, as many as 4 such consoles may be operated simultaneously and independently from a single, compact electronics package. The latter, measuring only about 5¼" D x 17" W x 14" H and containing all of the circuitry needed for the system, may be stored under a desk or in any convenient, out-of-the-way location. Individual consoles may be located for use at distances up to 200 feet from the electronics unit.

According to a Wang Laboratories official, the new time-sharing system will provide exceptional convenience and cost savings for large users of such calculators. He indicated that a 4-console system would actually cost considerably less than three other comparable, complete electronic calculators. He noted that no other manufacturer of electronic calculators can currently offer this time-sharing capability. Also of significance is the compactness of the keyboards which occupy no more space on a desk than a standard sheet of letterhead paper.
(For more information, designate #42 on the Readers Service Card.)

ROD MEMORY COMPUTER LINE EXPANDED BY NCR

The National Cash Register Company, Dayton, Ohio, has announced a major expansion of its 315 RMC (Rod Memory Computer) series, coupled with increased production and lower rental rates. Included in the newly announced equipment is a multi-programming computer, the first of its kind to be introduced by NCR.

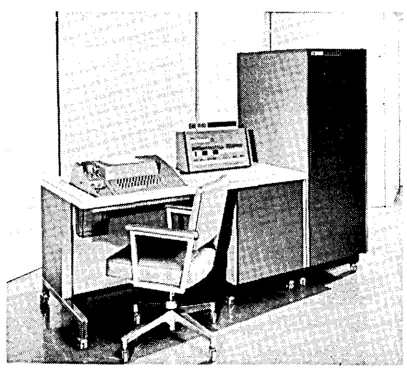
The system, called the 315-502, uses an 80,000-character thin-film memory processor. It is specifically designed to run a number of programs simultaneously by interleaving them according to priority. An "executive" program in the new system automatically handles all "privileged commands." The complete set of standard 315 computer programs may be used without recompiling. At least one random-access memory unit is required to take full advantage of the multiprogramming capabilities of the new system, which uses standard NCR 315 peripherals.

Also announced is a new 20,000-character rod memory module for the standard 315 RMC processor (315-501), and a number of new peripheral devices for the RMC series, including a special card read/punch controller, a central communications controller, and a magnetic tape simultaneity controller.
(For more information, designate #43 on the Readers Service Card.)

EAI 640 DIGITAL SYSTEM

Electronic Associates, Inc., West Long Branch, N.J., has introduced its second purely digital system in less than 24 months. The new general purpose computer, designated the EAI 640 Digital Computing System, offers the input-output flexibility and software for use both as a stand-alone system and for integration into hybrid and special computer-based systems.

EAI expects the 640 to make the greatest impact in the areas of process control, data acquisition and reduction, simulation, test and evaluation, bio-medicine and education. The company has prepared a complete program of system programming, customer training and field engineering to support these and other fields.



The EAI Central Processor provides facilities for monitoring and manually controlling all elements in the 640 computer system. The storage rack (shown at right) houses all required electronics and space for up to 16,000 words of core memory. Features of the 640 include: a 16-bit instruction and data word plus protect bit, a protected core memory with a 32,768 word storage capacity, a 1.65 microsecond memory cycle time, a repertoire of 62 instructions, multi-level interrupt capabilities and a capacity for communication with up to 64 peripheral devices. Maximum I/O rate is 1.2-million 8-bit bytes per second.

Options include expansions for teletype equipment, a direct memory-access channel —unusual for computers in this price category (below $30,000 for the basic system), and memory expansions from the basic 4K words to 8K, 16K or 32K.
(For more information, designate #44 on the Readers Service Card.)

E1400, BURROUGHS NEW BUSINESS SYSTEM

Further penetration of an expanding new market is predicted by Burroughs Corporation, Detroit, Mich., with announcement of its E1400 Electronic Computing/Accounting Machine. The E1400 is described as a complete electronic accounting system for data recording, computation, and business report preparation. The system reads and records data electronically using business forms bearing a magnetic-ink stripe.

The basic E1400 system includes an operator's console incorporating all features of Burroughs accounting machines, plus special purpose control keys and lights. Solid-state processing equipment performs arithmetic functions including instant multiplication. The processor has a 52-position magnetic core memory, and an additional wired memory for storing up to 27 constant factors such as discounts, rate steps, or interest rates. In addition, the machine provides 216 digits of mechanical memory. Of special interest to commercial and bank users is the E1400's ability to verify electronically that the correct customer account is being posted.

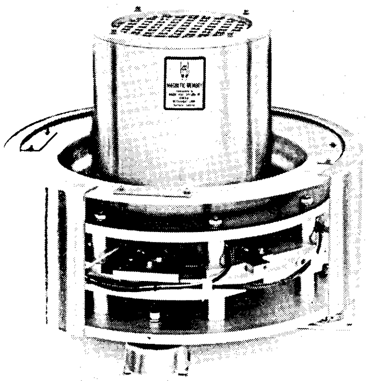
The new E1400 is in the low-to-intermediate range, selling from $15,400 to $25,000 depending upon optional features and adjuncts. It may also be leased.
(For more information, designate #45 on the Readers Service Card.)

Memories

MAGNE-HEAD INTRODUCES MAGNETIC MEMORY DISCS

A new line of magnetic memory discs, including 13 different models with storage capacities ranging from approximately 100,000 to over 10,000,000 bits, has been introduced by the Magne-Head Division of General Instrument Corp., Hawthorne, Calif.

The Magne-Head memory discs are available in four series, utilizing 7 inch, 9 inch, 11 inch and 13 inch diameter discs. Features



— Magnetic Memory Disc: cut-away in photo illustrates interior of typical disc

include: bit packaging densities to 1000 per inch NRZ, (600 per inch phase modulation); a signal-to-noise ratio of 20 db; and versatility of operation, with variable motor speeds available and record head inductance adjustable to any electronic interface.
(For more information, designate #46 on the Readers Service Card.)

NEW LARGE CAPACITY VERSASTORE MEMORY SYSTEMS FOR COMPUTER MAINFRAMES

Decision Control, Inc., Newport Beach, Calif., will announce its new series of large capacity VersaSTORE memory systems for computer mainframes at the Fall Joint Computer Conference this month. The VersaSTORE mainframe memories, designed and engineered around an expandable concept, are available in 16 K increments and capacities of 65 K, with word lengths to 36 or 72 bits. Integrated circuits are used in the new system for reliability levels unobtainable with discrete components having substantial reductions in physical size.

The new VersaSTORE mainframe memory series operates at 2 usec speeds with full or half cycle capabilities, with full read, modify an write capability. DTL interface is used throughout. Flexible input levels range from 3 v to 12 v with outputs to 5 v. The address and data circuits are packaged on plug-in cards, requiring minimum spares stocking. Front access to card modules and plug-in core stacks is provided, as well as necessary test points and adjustments.
(For more information, designate #47 on the Readers Service Card.)

Software

THREE NEW AUTOFLOW COMPUTER DOCUMENTATION SYSTEMS

Applied Data Research, Inc., Princeton, N.J., has announced the availability of three new AUTOFLOW Computer Documentation Systems: IBM 360 COBOL/AUTOFLOW; IBM 360 FORTRAN/AUTOFLOW; IBM 7090/94 FORTRAN/AUTOFLOW. AUTOFLOW is a proprietary automated flow chart system developed by ADR and marketed over the past 18 months. The new systems accept COBOL or FORTRAN source programs to produce flow charts using a computer and high speed printer.

All editing, page allocation, line drawing and statement rearrangement are performed automatically. Segments of the program which are logically related are arranged next to one another on the flow chart so that the flow of the program can be easily perceived. The statement rearrangement feature is unique to the AUTOFLOW System.
(For more information, designate #49 on the Readers Service Card.)

IBM COMPUTER DIRECTS PATTERN CUTTING

A computer now can cut clothing patterns of all sizes from a single original design. This new technique was demonstrated for the first time by IBM Corporation at the Needle Trades Management Exposition held in Charlotte, N.C. in September.

At the exposition an IBM 1130 computing system (at left in picture) directed a device, called a pattern generator,(right), in cutting patterns of all sizes. The automatic procedure preserves the style and proportion of the design-

er's original. A blouse pattern which has been cut by the new technique is shown being size-tested.

Robert D. White, national apparel and textile industry marketing representative of IBM's Data Processing Division, said that, although the computer would standardize size grading, it also could be programmed to allow for certain desirable variations within a size, such as special allowances for specific types of figures.

To prepare a master pattern for processing, its outline is traced by a digitizer. This is an electronic drafting table with an arm that moves along the pattern and records the dimensions on punched cards as mathematically precise points on an imaginary graph. The punched cards are then fed into the computer. The cutting takes place at the pattern generator, a second table-like device. This is basically a digital plotter which has been equipped with a special head to enable it to cut, as well as draw and write. After the plotter cuts the cardboard pattern, the computer directs a special writing tip to mark pertinent information on it — printing such data as size and style or drawing grain lines. The pattern is then used as a guide for cutting the fabric.

The pattern generator, its control unit, and the digitizer are manufactured by the Gerber Scientific Instrument Company of Hartford, Conn., and marketed by IBM. The pattern generator can be used with an IBM System/360 equipped with magnetic tape units, as well as with the 1130.
(For more information, designate #50 on the Readers Service Card.)

Input-Output

NEED FOR COMPUTER ELIMINATED BY NEW PHOTOTYPESETTER

Photo, Inc., Wilmington, Mass., has announced a new version of its 713 series Textmaster phototypesetting machine which produces hyphenless justified lines directly from tape perforated by simple non-counting keyboards. This enables printers and publishers to utilize very fast tape-punching procedures requiring minimum skills, yet without involving a computer. Photon's new Textmaster Model 20 is in effect its own computer.

The Textmaster Model 20's electronic control unit incorporates computer core memory as well as solid state circuitry. The control unit reads the tape at 500 characters per second. It chooses for itself the best line-ending point and then calculates the correct amount of space to be inserted equally between all words to extend the line to the standard justified length. An occasional combination of words which would cause unusually large inter-word spaces is automatically sensed and overcome by insertion of very fine increments of letter spacing within all the words in the line equally.

The control unit then sends electrical impulses by cable to the adjoining photographic unit, instructing the setting of type at 20 characters a second. In newspaper use that amounts to more than 35 lines a minute, or a level of productivity equal to three of the fastest hot metal typesetting machines available. Deliveries of the new machine will begin after January 1, 1967.
(For more information, designate #53 on the Readers Service Card.)

PHOTOLOGIC 100 SERIES TAPE READER

The new Photologic 100 Series Tape Reader, announced by Photologic Company, Garden Grove, Calif., employs only one moving part and completely solid state design. All gear, clutches, brakes, belts, pulleys or solenoids commonly used in similar readers are eliminated in the new tape reader. No routine maintenance or adjustment is required.

Reading speed is 100 characters per second in either direction, synchronously or asynchronously with stops on character. Either mylar or paper tape can be used in the Photologic 100 Series from five to eight level, from .002 to .008 inches thick.

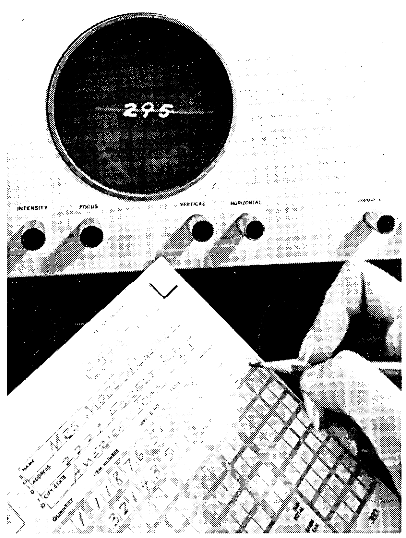
Eight lamps provide a 50,000 hour redundant light source covered by a glass protector. With the photo-electric read head similarly enclosed, the tape runs between the two protectors and cannot carry dust or foreign matter into the readout machine.

Four output options are available at no extra cost; mode changing is simplified with nine silicon transistor amplifiers built onto a single plug-in card. Independent tests conducted with the new punched tape reader under a variety of conditions resulted in 143,000,000 lines being read with no reading errors and no malfunctions.
(For more information, designate #54 on the Readers Service Card.)

IBM MACHINE READS HANDWRITTEN NUMBERS DIRECTLY INTO COMPUTER

The IBM 1287 optical reader, recently intorduced by IBM Corporation, White Plains, N.Y., can recognize numbers and five different hand-printed alphabetic characters pencil-written on a wide variety of business documents. It feeds this information directly into a computer for processing. Information written by clerks, warehouse personnel, truck drivers, field repairmen, production-line workers — nearly everybody in a business organization — can be entered directly into a computer system using the new optical reader. The machine is the first with this capability to be offered commercially.

Designed for use with IBM's System/360, the 1287 reads machine printed, credit card imprinted and pencil-marked numbers as well as handwritten numbers. It reads this type of information in any combination from paper forms and cash register or adding machine journal rolls. A company using



— Exact images of handwritten numbers, like those on the retail sales check, can be created on TV-like scope of IBM 1287 as machine reads them directly into a computer

the new reader does not have to convert pencil-written or printed numerical data into punched card machine language before entering it into a System/360. It is transmitted directly from source documents into a computer, saving time and money, and eliminating conversion errors.

A tiny "flying spot" of light traces the shape of a handwritten number, spiraling completely around the number before moving on. This technique is called "curve-following". Logic, built into the 1287, interprets the values of numbers traced by the flying spot and automatically transmits them, through cable connections to a System/360 for processing. The flying spot scans and curve-follows machine printed numbers at a rate of about 300 a second. Document reading speeds vary, however, depending on the size of the document, the amount of information to be read and the mix of written, printed, imprinted and pencil-marked numbers.
(For more information, designate #52 on the Readers Service Card.)

DIGITAL TAPE TRANSPORT FOR 21-TRACK RECORDING

A high-speed, single-capstan digital tape transport for 21-track recording on one-inch magnetic tape will be demonstrated by Ampex Corporation, Redwood City, Calif., at the Fall Joint Computer Conference this month in San Francisco. Eugene E. Prince, general manager of the Ampex computer products division, said the 21-track version of the Ampex Model TM-11 makes direct digital recording feasible in geophysical, medical and laboratory data acquisition projects where computer processing is a requirement.

Presently, most projects of this type can gather sufficient data on tape only by recording in analog form, which means the information must then be converted to digital format before it can be computer-processed. Ability to record as many as 21 tracks on one-inch tape at speeds up to 120 inches per second enables the special Ampex TM-11 to accommodate information in amounts sufficient for many direct data acquisition requirements, Prince said.
(For more information, designate #51 on the Readers Service Card.)

IBM OFFERS A NEW SERVICE FOR TAPES OF ALL MAKERS

A new service to extend the life of computer tapes which otherwise might have to be scrapped has been announced by IBM Corporation. Half inch 1.5 mil tapes of all manufacturers are included in the service.

A new machine, developed by IBM's Information Records Division, simultaneously decontaminates and evaluates the computer tape. It monitors the tape signal, comparing the signal to the standard for new tape and the minimum write-signal standard acceptable by the customer's tape drives. The machine then classifies each tape reel according to the customer's performance criteria.

IBM also has expanded its existing rehabilitation service to include tapes of all manufacturers. Both the new and the expanded services are offered at IBM's Minneapolis Tape Center.
(For more information, designate #55 on the Readers Service Card.)

RESEARCH FRONTIER

TELEPHONIC VOICE RESPONSE SYSTEM

A new system that enables an individual or businessman not only to use a computer over his personal telephone but to receive simple-to-understand verbal answers is bing tested by Stromberg-Carlson, a subsidiary of General Dynamics. The system is unique in that both the inquiry unit and the response device are contained in the same instrument, an ordinary Stromberg-Carlson push-button Tone-Dial telephone only slightly altered to accommodate the new system. Previous experimental systems that give verbal answers to telephoned inquiries require separate "black boxes" in addition to ordinary telephones.

The Tone-Dial telephones being used as prototypes are equipped with 12 buttons instead of the standard Stromberg-Carlson system's 10. One of the extra keys is like a typewriter's "Shift" key to make it possible for the digit keys to serve dual functions. The "4", for example, becomes a square root instruction in "uppercase", the "8" a plus instruction. The instrument's other extra key is for a decimal point and for obtaining the verbal answer when the caller has completed sending his problem.

The caller reaches his computer the same way he would anyone he is calling — by pushing buttons to form telephone numbers. Tied in with the computer itself is a voice response device, which has at its heart a vocabulary memory in which are stored all of the words, numbers and simple phrases required to formulate any answers the company's data processing machines are capable of handling.

— The voice response unit that makes the system operate can be seen in background as the secretary awaits an answer from her Tone-Dial telephone

At the Stromberg-Carlson plant (Rochester, N.Y.), a dozen different types of offices have been equipped with the experimental system, which terminates in a calculator rather than computer. It has found rapid acceptance from those who normally have insufficient requirements for their own desk calculators but now share one by telephone.

The company's experimenters foresee usage of the telephonic voice response system not only for daily business calculations, but for individual use in finding out anything from airline arrival-and-departure times to the price of meat at the local supermarket. The number of applications where an economical "voice-readout" system in machine-man communications would enable users to obtain valuable information are almost limitless.

Newsletter

PEOPLE OF NOTE

HARRY GOODE MEMORIAL HONORS TO ECKERT AND MAUCHLY

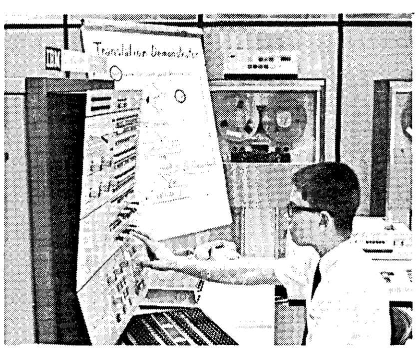
Dr. J. Presper Eckert and Dr. John W. Mauchly are to be honored for "pioneering contributions to automatic computing" with the presentation of the annual Harry Goode Memorial Award at the 1966 Fall Joint Computer Conference, San Francisco, November 8-10. Dr. Eckert is vice president of the UNIVAC/AC Division of Sperry Rand Corp. and Dr. Mauchly is founder and board chairman of Mauchly Associates, Inc., which he organized in the spring of 1959.

The Harry Goode Award to Drs. Eckert and Mauchly, announced from the New York headquarters of the American Federation of Information Processing Societies, is largely based on their participation in the design and construction of the ENIAC, the world's first all-electronic computer, and of the BINAC and the UNIVAC I.

Dr. Eckert also is being honored for his continued contributions in electronic computer design and Dr. Mauchly is being cited for pioneering efforts involving computers to solve scientific and business problems. The award will be made at the FJCC conference luncheon on Wednesday, November 9.

THIRTEEN-YEAR OLD STUDENT TO ADDRESS COMPUTER EXPERTS

Thirteen-year old John Sybalsky, is working on a computer program that can process the solution to many different, though basically similar, problems. In the picture, he is shown using an IBM System/360 computer to demonstrate that his



program can translate, in a limited way, French to English, music from one key to another, and even one computer language to another computer language. John's paper reporting on his work was one of three judged best by the reviewers in a contest for college undergraduate papers conducted by the Committee on Student Membership of the Association for Computing Machinery (ACM).

In his talk entitled "A General-Purpose Translation Demonstrator," presented at the Undergraduate Students' Papers session on August 31, 1966, at the Annual Meeting of the ACM, young Sybalsky displayed his computer programs to show how he succeeded in using computers in three ways: by use of a single computer program to do many different jobs; by solving the same problems using two different computer languages; and by using a single computer language on several different computers.

John's computer concepts and programming course was a part of his regular seventh grade schoolwork and is part of the experimental curriculum at the Spackenkill Junior High School in Poughkeepsie, N.Y.

SMITH NAMED TO NEW EXECUTIVE POST BY HONEYWELL

Honeywell Inc. has created a new executive post to direct expansion of its European computer activities. Claude H. Smith has been named vice president, computer operations, Europe. He will be in charge of the firm's computer manufacturing, marketing, education and support activities in the United Kingdom and on the European continent. Smith will direct the activities of both the EDP and Computer Control divisions, whose products range from business data processing systems to special-purpose computers and components.

Smith had been marketing vice president of Honeywell's Electronic Data Processing division in the United States for nearly five years, and has resided in Wellesley, Mass., for that period. He will be headquartered at the Brentford, England office of the company's British subsidiary, Honeywell Controls Ltd.

JOBS & OPPORTUNITIES

PERSONNEL INFORMATION COMMUNICATION SYSTEM (PICS)

A new, nationwide job-finding service, developed by Information Science, Inc., using a computer to match qualified men with positions they want, has been announced by Russell W. McFall, president of Western Union. The service, part of Western Union's expanding operation as a national information utility, is being marketed for Information Science, Inc., of White Plains, N.Y., in which Western Union has purchased a one-third interest with an option to acquire the remaining interest at a later date.

The career information service is called PICS (Personnel Information Communication System). The system uses computers to match the qualifications, earnings and other data about professional, technical and administrative people with the requirements of employers looking for identical talent.

PICS service works like this: A person wanting to be aware of opportunities in their own or related fields, simply calls Western Union and asks for "Operator 77". The operator takes the caller's name and address, and he is sent information about the service including special forms for listing the applicant's skills, qualifications, position and salary requirements. When an individual returns this data, it is stored in a central computer system. For a membership fee of $1 a month (payable annually), skills, preferences, and background are classified in more than 1300 different categories and these individual profiles are matched daily with all career opportunities.

Employers seeking talent call Western Union and ask for "Operator 88." They are sent "recruitagram" forms which detail job specifications — including skills and salaries. This data is then fed into the PICS computer which matches individual skills against the job opportunity. Each job is checked by computer against all PICS members. Each time an individual's record matches an opening, which represents a higher salary for him, he receives a detailed description of the job. At the same time a confidential resume is sent to the interested company, identified only by code, omitting the PICS member's name and employer.

The identity of any individual is disclosed only when the company is interested in interviewing him. There is no obligation to accept or even consider any position and if a position is accepted there is no placement fee. Employers using the service pay a fee for each computer search and a nominal fee for each resume which matched on the computer search. A company can specify the number of resumes desired.

Information Science emphasized that they are not in the employment agency business and PICS is not primarily for the unemployed job seeker. PICS is a computerized information system, matching professional skills with professional opportunities, nationwide. A separate information service for agencies concerned with immediate job placements will be announced early in 1967.

BUSINESS NEWS

IBM, HONEYWELL MAKE EDP PRICE CHANGES

Fall has marked a new season of price "adjustments" in the computer field. The current tight money market is apparently the main catalyst evoking the changes. IBM and Honeywell provide early examples of this trend.

IBM has announced that rental prices on most 360 computers will be increased by approximately 3%, effective January 1, 1967. Also, purchase prices on the same equipment will be reduced about 3%, effective Sept. 19, 1966. Second generation equipment, such as 1400 and 7000 series computers, remain unaffected by the adjustments.

Honeywell has announced increases from 2% to 4% on both the rental and purchase prices of its 200 series computers, effective Dec. 15, 1966. According to Walter Finke, Honeywell computer group vice president, his EDP division is increasing by more than 50% its spending for software, and "this factor, combined with the increasing cost of obtaining money to finance the rapid growth of our deferred-income business, has necessitated the selective price increases."

$12 BILLION EDP MARKET FORECASTED

By 1970 the EDP market is expected to have an annual turnover of $12 billion in hardware and software, according to Dr. Walter Bauer, President of Informatics, Inc. In an article in a recent issue of EDP Analyzer, Bauer predicts EDP hardware will account for $5 billion and software for $7 billion a year by 1970. For 1965, his figures show an estimated $2.8 billion in hardware and $3.2 billion in software being spent. The software figures include user expenditures for salary and overhead for programming and systems analysis departments.

Bauer expects that independent software firms will realize an increase in their percentage of the market from the present 3% to 10% by 1970. This would be a gain from about $100 million to $600 million within four years.

ICT COMPUTER PERIPHERAL SHIPMENTS UP 50%

International Computers and Tabulators, London, reports shipment of punch card readers, punches, and other peripheral equipment worth more than $2.8 million in the year ended Sept., 1966. This is up more than 50% from the same period last year, and double the figure for 1964. ICT says that nearly all its orders for peripherals have come from other computer manufacturers, mostly in the U. S.

ICT's own computer line, the 1900 series, is reported to have logged in over 600 orders since its introduction last year.

MOHAWK REGISTERS NEW STOCK OFFERING

Mohawk Data Sciences Corp. filed with the SEC in early October a registration statement for a proposed offering of 275,000 shares of common stock. The offering, being underwritten by a group headed by A. G. Becker & Co., will include 200,000 shares sold by the company and 75,000 shares to be sold by a group of stockholders, of whom several are officers of the company.

Mohawk DSC, organized in August, 1964, is engaged in the development, manufacture and sale or rental of EDP equipment, with its principal product line being devices to transcribe information from source documents and other media directly to standard computer magnetic tape by keyboard operation.

The company reported a loss of $828,799 for the fiscal year ended July 31st on sales of $2,407,125. The company turned the profit corner for the first time in its history, however, in the fourth quarter, with earnings of $46,550 on sales of $1,421,131.

INCREASED GROWTH SEEN FOR PROCESS CONTROL MARKET

A 30% annual growth rate for the world process control market during the next five years has been predicted by R. C. Berendsen, manager of G.E.'s Process Computer Business Section.

Speaking at the recent 1966 Iron and Steel Show, Mr. Berendsen noted that "the process computer has formed a permanent niche for itself in management's thinking, and is becoming a pivotal factor in long-range industrial operations planning. The process computer market will more than quadruple by 1971, with a total market potential approaching $1 billion in this period."

The GE executive disclosed that recent marketing studies by his firm indicates that steel, petroleum, chemical and electric utilities industries combined represent about three-fourths of process computer sales at the current time. However the picture by 1971 is expected to show that while the electric utility industry continues to be a major process computer user, petroleum and chemical firms will have enlarged their proportion of the total market. In addition, automobile makers, aerospace, transportation and food processor should show promising increases in process control computer purchases during the next five years, Mr. Berendsen remarked.

NEW PATENTS

RAYMOND R. SKOLNICK
Reg. Patent Agent
Ford Inst. Co., Div. of Sperry Rand Corp., Long Island City 1, New York

The following is a compilation of patents pertaining to computers and associated equipment from the "Official Gazette of the U. S. Patent Office," dates of issue as indicated. Each entry consists of: patent number / inventor(s) / assignee / invention. Printed copies of patents may be obtained from the U.S. Commissioner of Patents, Washington, D.C. 20231, at a cost of 50 cents each.

August 16, 1966

3,267,434 / Robert E. Clark, Wallace N. Patterson, and Theodore D. Thomas, Phoenix, Arizona / assignors to General Electric Company / Information Handling System.

3,267,435 / Charles H. Propster, Jr., San Jose, Calif. / assignor to General Electric Company / Multiple Shift Register.

3,267,440 / Jens Piening and Horst Girke, Munich, Germany / assignors to Siemens & Halske Altiengesellschaft, Germany / Circuit Arrangement for Reading Digital Signals.

3,267,441 / Donald F. Busch, Vestal, N.Y. / assignor to International Business Machines Corporation / Magnetic Core Gating Circuits.

3,267,442 / Holger R. Jensen, Jr., Endicott, N.Y. / assignor to International Business Machines Corporation / Memory Matrix.

3,267,443 / James M. Brownlow, Crompond, N.Y. / assignor to International Business Machines Corporation / Magnetic Memory Element.

3,267,444 / Andre Michael Richard, Paris, France / assignor to Societe d'Electronique et d'Automatiseme, Courbevoie, France / Magnetic Core Circuits for Binary Coded Information.

3,267,445 / Brandt P. Ochsner, Gillette, and James L. Smith, Bedminster, N.J. / assignors to Bell Telephone Laboratories, Inc. / Magnetic Memory Circuits.

3,267,446 / Edvin L. Woods, Tustin, and Robert L. Koppel, Orange, Calif. / assignors, by mesne assignments, to Raytheon Company / Memory Decoupling Circuit.

3,267,447 / Lawrence R. Bickford, Jr., Tokyo, Japan, and Robert F. Elfant, Yorktown Heights, N.Y. / assignors to International Business Machines Corporation / Magnetic Memory.

August 23, 1966

3,268,865 / George M. Berkin, Muiderberg, Netherlands, / assignor to International Business Machines Corporation / Character Recognition System Employing Recognition Circuit Deactivation.

3,268,866 / Antonie Wijbe van't Slot and Willem Smit, Hilversum, Netherlands / assignors to North American Philips Company, Inc. / Circuit Arrangement for Controlling Switching Matrices.

3,268,872 / Joseph A. Limlinger, St. Paul, Minn. / assignor to Sperry Rand Corporation / Stored Program Data Processing System.

3,268,873 / Bernard K. Betz, Hopkins, Minn. / assignor to Honeywell, Inc. / Information Handling Apparatus Including Instruction Suppression Means.

3,268,874 / Robert V. Bock, Sierra Madre, Calif. / assignor to Burroughs Corporation / Computer Multi-Register Linkage With A Memory Unit.

August 30, 1966

3,270,185 / William C. Farley, Yonkers, N.Y. / assignor to Kimball Systems, Inc. / Data Conversion System.

3,270,321 / Milton Berkowitz, King of Prussia, Pa., / assignor to General Electric Company / Selective Data Sampling System.

3,270,322 / Jean-Francois Ledoux, Paris, and André Feyzeau, St.-Maur, France / assignors to CIT Compagnie Industrielle des Telecommunications, France / Core Matrix System for Monitoring a Plurality of Contacts.

3,270,325 / Richard S. Carter and Walter W. Welz, Poughkeepsie, N.Y. / assignors to International Business Machines Corporation / Parallel Memory, Multiple Processing, Variable Word Length Computer.

3,270,326 / Sidney J. Schwartz and William F. Chenoweth, Dayton, Ohio / assignors to The National Cash Register Company / Thin Film Magnetic Storage Device.

September 6, 1966

3,271,581 / Paul T. Harper, Los Altos, Calif. / assignor to Lockheed Aircraft Corp. / Magnetic Nor Device.

3,271,582 / Saul B. Yochelson, Northridge, Calif. / assignor to Goodyear Aircraft Corp. / Magnetic Core Logic Circuits.

3,271,741 / Albert M. Bates, Davisville, Pa. / assignor to Burroughs Corp. / Magnetic Memory System.

3,271,747 / Donald R. Harner, Shiremanstown, and Michael Plaxa, Camp Hill, Pa. / assignors to AMP Inc. / Magnetic Core Package.

3,271,748/ Robert F. Elfant, Yorktown Heights, and Nicholas J. Mazzeo, Peekskill, N.Y. / assignors to International Business Machines Corp. / Magnetic Element and Memory.

September 13, 1966

3,273,122 / Gerald F. Chandler, La Mesa, Calif. / assignor to Cohu Electronics, Inc. / Digital Comparator.

3,273,129 / Alvin P. Mullery, Chappaqua, and Ralph F. Schauer, Hawthorne, N.Y. / assignors to International Business Machines Corp. / Computer Data Storage and Handling System Having Means for Linking Discontinuous Data.

September 20, 1966

3,274,379 / Karl Hinrichs, Fullerton, Calif. / assignor to Beckman Instruments, Inc. / Digital Data Correlator.

3,274,398 / David L. Jones, Kensington, Md. / assignor, by mesne assignments, to the United States of America as represented by the Secretary of the Navy / Video Gate with Pedestal Cancellation.

3,274,554 / Warren W. Hopper, West Chester, Stanley J. Pezely, Norristown, Leonard H. Sichel, Jr., Bryn Mawr, Ronald B. Lounsbury, St. Davids, and Patricia V. Zimmerman, Oreland, Pa. / assignors to Burroughs Corp. / Computer System.

3,274,562 / George B. Strawbridge, St. Paul, Minn. / assignor to Sperry Rand Corp. / Memory Apparatus Wherein the Logical Sum of Address and Data Is Stored at Two Addressable Locations.

3,274,564 / Alfred A. Binder, Cincinnati, Ohio, and Thomas J. Linder, Eau Gallie, Fla. / assignors to Avco Corp. / Data Processor.

3,274,568 / Warren A. Christopherson, San Jose, Calif. / assignor to International Business Machines Corp. / Magnetic Core Matrix Switch.

3,274,571 / Andrew H. Bobeck, Chatham, and James L. Smith, Bedminster, N.J. / assignors to Bell Telephone Laboratories, Inc. / Magnetic Memory Circuits.

MONTHLY COMPUTER CENSUS

The number of electronic computers installed or in production at any one time has been increasing at a bewildering pace in the past several years. New vendors have come into the computer market, and familiar machines have gone out of production. Some new machines have been received with open arms by users — others have been given the cold shoulder.

To aid our readers in keeping up with this mushrooming activity, the editors of COMPUTERS AND AUTOMATION present this monthly report on the number of general purpose electronic computers of American-based companies which are installed or on order as of the preceding month. These figures included installations and orders outside the United States. We update this computer census monthly, so that it will serve as a "box-score" of progress for readers interested in following the growth of the American computer industry, and of the computing power it builds.

In general, manufacturers in the computer field do not officially release installation and on order figures. The figures in this census are developed through a continuing market survey conducted by associates of our magazine. This market research program develops and maintains a data bank describing current computer installations in the United States. A similar program is conducted for overseas installations.

Any additions, or corrections, from informed readers will be welcomed.

AS OF OCTOBER 10, 1966

NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFILLED ORDERS
ASI Computer	ASI 210	Y	$3850	4/62	25	0
	ASI 2100	Y	$4200	12/63	7	0
	ADVANCE 6020	Y	$4400	4/65	12	4
	ADVANCE 6040	Y	$5600	7/65	6	5
	ADVANCE 6050	Y	$9000	2/66	4	6
	ADVANCE 6070	Y	$15,000	10/65	5	6
	ADVANCE 6130	Y	$1000	11/66	0	7
Autonetics	RECOMP II	Y	$2495	11/58	38	X
	RECOMP III	Y	$1495	6/61	8	X
Bunker-Ramo Corp.	BR-130	Y	$2000	10/61	160	2
	BR-133	Y	$2400	5/64	24	45
	BR-230	Y	$2680	8/63	15	X
	BR-300	Y	$3000	3/59	36	X
	BR-330	Y	$4000	12/60	32	X
	BR-340	Y	$7000	12/63	20	X
Burroughs	205	N	$4600	1/54	44	X
	220	N	$14,000	10/58	35	X
	E101-103	N	$875	1/56	130	X
	B100	Y	$2800	8/64	158	17
	B250	Y	$4200	11/61	85	1
	B260	Y	$3750	11/62	230	5
	B270	Y	$7000	7/62	162	6
	B280	Y	$6500	7/62	129	8
	B300	Y	$10,000	7/65	110	88
	B2500	Y	$5000	1/67	0	36
	B3500	Y	$14,000	5/67	0	24
	B5500	Y	$22,000	3/63	58	14
	B6500	Y	$33,000	2/68	0	7
	B8500	Y	$200,000	2/67	0	1
Control Data Corporation	G-15	N	$1600	7/55	310	X
	G-20	Y	$15,500	4/61	23	X
	LGP-21	Y	$725	12/62	118	X
	LGP-30	semi	$1300	9/56	122	X
	RPC-4000	Y	$1875	1/61	55	X
	160*/160A/160G	Y	$2100/$5000/$12,000	5/60;7/61;3/64	456	7
	924/924A	Y	$11,000	8/61	26	X
	1604/1604A	Y	$45,000	1/60	59	X
	1700	Y	$4000	5/66	18	105
	3100	Y	$11,000	12/64	95	35
	3200	Y	$14,000	5/64	90	X
	3300	Y	$15,000	9/65	27	45
	3400	Y	$25,000	11/64	19	X
	3500	Y	$30,000	10/66	0	16
	3600	Y	$58,000	6/63	50	X
	3800	Y	$60,000	2/66	8	15
	6400	Y	$50,000	5/66	7	17
	6600	Y	$85,000	8/64	19	12
	6800	Y	$130,000	4/67	0	4
Data Machines, Inc.	620	Y	$900	11/65	22	30
Digital Equipment Corp.	PDP-1	Y	$3400	11/60	60	X
	PDP-4	Y	$1700	8/62	57	X
	PDP-5	Y	$900	9/63	115	1
	PDP-6	Y	$10,000	10/64	22	3
	PDP-7	Y	$1300	11/64	88	48
	PDP-8	Y	$525	4/65	450	280
	PDP-9	Y	$1000	12/66	0	35
El-tronics, Inc.	ALWAC IIIE	N	$1820	2/54	17	X
Electronic Associates, Inc.	8400	Y	$10,000	6/65	9	9
Friden	6010	Y	$600	6/63	450	80
General Electric	115	Y	$2000	12/65	160	575
	205	Y	$2900	6/64	44	X
	210	Y	$16,000	7/59	50	X
	215	Y	$6000	9/63	54	X
	225	Y	$8000	4/61	205	X
	235	Y	$10,900	4/64	67	3
	415	Y	$9600	5/64	185	65
	425	Y	$18,000	6/64	75	45
	435	Y	$25,000	9/65	29	18
	625/635	Y	$55,800	5/65	35	33
	645	Y	$90,000	7/66	2	10
Honeywell	DDP-24	Y	$2500	5/63	80	5
	DDP-116	Y	$900	4/65	115	45
	DDP-124	Y	$2050	3/66	15	45
	DDP-224	Y	$3300	3/65	38	10
	H-120	Y	$3500	1/66	240	270
	H-200	Y	$5700	3/64	885	135
	H-400	Y	$8500	12/61	117	X

31

NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFILLED ORDERS
Honeywell (cont'd)	H-800	Y	$26,000	12/60	89	3
	H-1200	Y	$7300	2/66	22	72
	H-1400	Y	$14,000	1/64	12	1
	H-1800	Y	$35,000	1/64	17	2
	H-2200	Y	$13,000	1/66	14	52
	H-4200	Y	$20,500	3/67	0	6
	H-8200	Y	$35,000	3/68	0	2
	DATAmatic 1000	N	$40,000	12/57	3	X
IBM	305	N	$3600	12/57	146	X
	360/20	Y	$2000	12/65	725	6300
	360/30	Y	$7500	5/65	1950	4550
	360/40	Y	$15,000	4/65	1000	1550
	360/44	Y	$10,000	7/66	10	125
	360/50	Y	$26,000	8/65	120	550
	360/62	Y	$55,000	11/65	1	X
	360/65	Y	$50,000	11/65	20	205
	360/67	Y	$75,000	10/66	0	60
	360/75	Y	$78,000	2/66	10	30
	360/90 Series	Y	$140,000	6/67	0	9 — 9
	650	N	$4800	11/54	175	X
	1130	Y	$1200	11/65	400	3800
	1401	Y	$6600	9/60	7700	250
	1401-G	Y	$2300	5/64	1580	50
	1410	Y	$14,200	11/61	800	75
	1440	Y	$4800	4/63	3200	200
	1460	Y	$11,500	10/63	1750	75
	1620 I, II	Y	$4000	9/60	1680	20
	1800	Y	$7600	1/66	45	275
	701	N	$5000	4/53	1	X
	7010	Y	$22,600	10/63	210	6
	702	N	$6900	2/55	6	X
	7030	Y	$160,000	5/61	6	X
	704	N	$32,000	12/55	32	X
	7040	Y	$22,000	6/63	120	4
	7044	Y	$32,000	6/63	121	5
	705	N	$38,000	11/55	52	X
	7070, 2, 4	Y	$27,000	3/60	328	X
	7080	Y	$55,000	8/61	85	X
	709	N	$40,000	8/58	9	X
	7090	Y	$63,500	11/59	45	X
	7094	Y	$72,500	9/62	118	2
	7094 II	Y	$78,500	4/64	126	6
Monroe Calculating Machine Co.	Monrobot XI	Y	$700	12/60	480	100
National Cash Register Co.	NCR - 304	Y	$14,000	1/60	26	X
	NCR - 310	Y	$2500	5/61	20	X
	NCR - 315	Y	$8500	5/62	350	100
	NCR - 315-RMC	Y	$12,000	9/65	52	75
	NCR - 390	Y	$1850	5/61	1025	40
	NCR - 500	Y	$1500	10/65	510	830
Philco	1000	Y	$7010	6/63	16	X
	2000-210, 211	Y	$40,000	10/58	16	X
	2000-212	Y	$52,000	1/63	10	X
Radio Corporation of America	RCA 301	Y	$7000	2/61	645	2
	RCA 3301	Y	$17,000	7/64	64	9
	RCA 501	Y	$14,000	6/59	97	X
	RCA 601	Y	$35,000	11/62	5	X
	Spectra 70/15	Y	$4100	9/65	62	105
	Spectra 70/25	Y	$6700	9/65	34	58
	Spectra 70/35	Y	$10,400	7/66	5	85
	Spectra 70/45	Y	$17,400	11/65	15	105
	Spectra 70/55	Y	$40,500	11/66	0	12
Raytheon	250	Y	$1200	12/60	175	X
	440	Y	$3500	3/64	16	3
	520	Y	$3200	10/65	17	8
Scientific Control Corporation	650	Y	$500	5/66	1	8
	655	Y	$1800	10/66	0	2
	660	Y	$2000	10/65	5	3
	670	Y	$2600	5/66	1	2
Scientific Data Systems Inc.	SDS-92	Y	$1500	4/65	64	30
	SDS-910	Y	$2000	8/62	182	6
	SDS-920	Y	$2900	9/62	133	12
	SDS-925	Y	$3000	12/64	27	10
	SDS-930	Y	$3400	6/64	125	20
	SDS-940	Y	$10,000	4/66	5	12
	SDS-9300	Y	$7000	11/64	28	8
	Sigma 2	Y	$1000	1/67	0	50
	Sigma 7	Y	$12,000	12/66	0	24
Systems Engineering Labs	SEL-810/810A	Y	$1000	9/65	24	8
	SEL-840/840A	Y	$1400	11/65	4	4
UNIVAC	I & II	N	$25,000	3/51 & 11/57	26	X
	III	Y	$20,000	8/62	77	X
	File Computers	N	$15,000	8/56	16	X
	Solid-State 80 I, II 90 I, II & Step	Y	$8000	8/58	260	X
	418	Y	$11,000	6/63	90	40
	490 Series	Y	$35,000	12/61	108	55
	1004	Y	$1900	2/63	3200	50
	1005	Y	$2400	4/66	375	300
	1050	Y	$8000	9/63	290	45
	1100 Series (except 1107)	N	$35,000	12/50	11	X
	1107	Y	$55,000	10/62	29	X
	1108	Y	$65,000	9/65	22	50 — 72
	9200	Y	$1500	6/67	0	500
	9300	Y	$3400	6/67	0	125
	LARC	Y	$135,000	5/60	2	X
				TOTALS	31,488	21,181

X = no longer in production.

* To avoid double counting, note that the Control Data 160 serves as the central processor of the NCR 310. Also, many of the orders for the IBM 7044, 7074, and 7094 I and II's are not for new machines but for conversion from existing 7040, 7070, and 7090 computers respectively.

BOOKS AND OTHER PUBLICATIONS: Reviews

Neil Macdonald
Assistant Editor
Computers and Automation

We publish here citations and brief reviews of books and other publications which have a significant relation to computers, data processing, and automation, and which have come to our attention. We shall be glad to report other information in future lists if a review copy is sent to us. The plan of each entry is: author or editor / title / publisher or issuer / date, publication process, number of pages, price or its equivalent / comments. If you write to a publisher or issuer, we would appreciate your mentioning **Computers and Automation.**

Cheydleur, Benjamin F., editor, and 18 authors / Colloquium on Technical Preconditions for Retrieval Center Operations / Spartan Books, Inc., Washington, D. C. / 1965, printed, 156 pp., $6.75

This is the proceedings of a conference called by the Special Interest Group on Information Retrieval of the Association for Computing Machinery, and the Moore School of Electrical Engineering of the University of Pennsylvania, April 24 and 25, 1964. Twelve papers are grouped in three parts; the first part is "Towards Reactivity within a Retrieval Complex."

The book seems highly technical, quite ununified, and of narrow interest.

Solodovnikov, V. V., editor, and 12 authors / Automatic Control and Computer Engineering, Vol. 3, translated from the Russian / Pergamon Press Inc., 122 E. 55th St., New York, N. Y. 10022 / 1966 1st English printing (Russian edition 1960), printed, 445 pp., $15.50

Contains 10 papers, with such subjects as "Control algorithms and control computers in complex automation", "Concerning the non-stationary properties of pulse systems," etc.

Hattery, Lowell H., and George P. Bush, editors, and 15 authors / Automation and Electronics in Publishing / Spartan Books, Washington, D. C. / 1965, printed, 206 pp., $?

This book is derived from a symposium in May 1965 sponsored by the Center for Technology and Administration of the American University, Washington, D. C., but it also contains some additional chapters and a bibliography. The papers were invited, and cover many aspects of printing as affected by automation and electronics.

This book would be useful to a person interested in this field, and contains many worthwhile ideas.

Kent, Allen, and Orrin E. Taulbee, editors, and 26 authors / Electronic Information Handling / Spartan Books, Inc., Washington, D. C. / 1965, printed, 355 pp., $?

This book consists of the proceedings of a conference held October 7-9, 1964, in Pittsburgh, lead by the Knowledge Availability Systems Center (Univ. of Pittsburgh) and cosponsored by the University of Pittsburgh, Goodyear Aerospace Corp., and Western Michigan Univ. Many well-known experts in the computer field were invited and contributed interesting papers.

This book seems to be partially (though not completely) unified, and is in a number of places interesting and informative.

Rubinoff, Morris, editor, and 18 authors / Toward a National Information System: Proceedings of the Second Colloquium on Information Retrieval / Spartan Books, 1250 Conn. Ave., N.W., Washington, D. C., 20036 / 1965, printed, 242 pp. $9.50

Contains 17 interesting papers, related to the general theme.

Hintze, G. / Fundamentals of Digital Machine Computing / Springer-Verlag, Inc., 175 Fifth Ave., New York, N. Y. 10010 / 1966, printed, 225 pp., $6.40

The seven chapters are: The Role and Principal Attributes of Digital Computers; Binary Numbers and Codes and Their Machine Representation; The Principles of Logic in Computers; Arithmetic Operations of the Machine; The Instruction Code of the Computer; Principles and Examples of Programming; Automatic Programming. The book is very elementary in most places, and in places not correct. For example, some of the statements on page 45 about the historical development of symbolic logic are wrong. The book is inconsistent in its assumptions about the nature of its readers: for example, "Backus normal form" is used as a term without any explanation of its meaning.

McCarthy, E. Jerome, and J. A. McCarthy, authors; Durward Humes, editor / Integrated Data Processing Systems / John Wiley & Sons, Inc., 605 3rd Ave., New York, N. Y. / 1966, printed, 565 pp., $8.95

The authors are a professor in a graduate school of business administration and an industry representative of International Business Machines Corp.

The book is written for people with little background; it "may be considered an introduction to machine manufacturers' reference manuals"; and the first half of the book deals almost entirely with punch card data processing.

Fox, L., editor, and 9 authors / Advances in Programming and Non-Numerical Computation / Pergamon Press Inc., 44-01 21st St., Long Island City, N. Y. 11101 / 1966, printed, 218 pp., $10.00

Contains articles and papers on list programming, artificial languages, game-playing, theorem-proving, etc.

The book is unified and important; in places, it is difficult.

Notices

Ceschino, F., and J. Kuntzmann / Numerical Solution of Initial Value Problems / Prentice-Hall, Inc., Englewood Cliffs, N. J. / 1966, printed, 318 pp., $14.00

Hampl, Miloslav, editor, and 29 authors / Information Processing Machines, No. 11: 16 Papers / Nakladatelstvi Ceskoslovenske Akademie Věd, Praha, Czechoslovakia / 1965, printed, 268 pp., $?

Malchow, M. E. / RCA Linear Integrated Circuit Fundamentals / Radio Corp. of America, Harrison, N. J. / 1966, photo offset, 240 pp., $2.00

DeFrance, J. J. / Communications Electronics Circuits / Holt, Rinehart and Winston, 383 Madison Ave., New York, N. Y. 10017 / 1966, printed, 548 pp., $9.50

Smith, Harold W. / Approximate Analysis of Randomly Excited Nonlinear Controls / The M.I.T. Press, Cambridge, Mass. / 1966, photo offset, 138 pp., $7.50

Public Automated Systems Service / Automation in the Public Service: An Annotated Bibliography / Public Administration Service, 1313 East 60th St., Chicago 37, Ill. / 1966, printed paperbound, 70 pp., $?

Aizenshtadt, V. S., and Krylor, V. I.; Translated from the Russian by Prasenjit Basu / Tables of Laguerre Polynomials and Functions / Pergamon Press, 44-01 21st St., Long Island City, New York, N. Y. 11101 / 1966, printed, 149 pp., $8.00; (first published 1963 by the Academy of Sciences of the B.S.S.R., Minsk)

Tonge, F. M. / Some Reflections on a Survey of Research Problems in Computer Software / Clearinghouse for Federal Scientific and Technical Information, Department of Commerce, Washington, D. C. / 1965, microeofiche, 22 pp., $.50

CALENDAR

OF

COMING

EVENTS

Nov. 8-10, 1966: Fall Joint Computer Conference, Brooks Hall, Civic Center, San Francisco, Calif.; contact R. George Glaser, General Chairman, Suite 1060, 100 California St., San Francisco, Calif. 94111.

Nov. 15-18, 1966: GUIDE International, Americana Hotel, Miami Beach, Fla.; contact Lois E. Mechan, Secretary, GUIDE International, c/o United Services Automobile Assoc., 4119 Broadway, San Antonio, Texas 78215

Nov. 17-18, 1966: Southwest Conference on Computers in Humanistic Research, Texas A&M Univ., College Station, Tex.; contact Milton A. Huggett, Center for Computer Research in the Humanities, College Station, Tex.

Nov. 28-30, 1966: COMMON User Group (formerly 1620 User Group), Jung Hotel, New Orleans, La.; contact Wiltz P. Champagne, c/o Computing Center, University of Southwestern Louisiana, Lafayette, La.

Mar., 1967: Fifth Annual Symposium on Biomathematics and Computer Science in the Life Sciences, Shamrock Hilton Hotel, Houston, Texas; contact Office of the Dean, Division of Continuing Education, the University of Texas Graduate School of Biomedical Sciences, 102 Jesse Jones Library Bldg., Texas Medical Center, Houston, Texas 77025

April 18-20, 1967: Spring Joint Computer Conference, Chalfonte-Haddon Hall, Atlantic City, N.J.; contact AFIPS Hdqs., 211 East 43 St., New York, N.Y. 10017

May 9-11, 1967: Spring Joint Computer Conference, Convention Center, Philadelphia, Pa.; contact AFIPS Headquarters, 211 E. 43rd St., New York, N.Y. 10017

May 18-19, 1967: 10th Midwest Symposium on Circuit Theory, Purdue University, Lafayette, Ind.

June 28-30, 1967: 1967 Joint Automatic Control Conference, University of Pennsylvania, Philadelphia, Pa.; contact Lewis Winner, 152 W. 42nd St., New York, N.Y. 10036

Aug. 28-Sept. 2, 1967: AICA (International Association for Analogue Computation) Fifth Congress, Lausanne, Switzerland; contact secretary of the Swiss Federation of Automatic Control, Wasserwerkstrasse 53, CH 8006 Zurich, Switzerland

Aug. 29-31, 1967: 1967 ACM (Association for Computing Machinery) National Conference, Twentieth Anniversary, Sheraton Park Hotel, Washington, D.C.; contact Thomas Willette, P.O. Box 6, Annandale, Va. 22003

Sept. 11-15, 1967: 1967 International Symposium on Information Theory, Athens, Greece; contact A. V. Balakrishnan, Dept. of Engineering, U.C.L.A., Los Angeles, Calif. 90024

Nov. 14-16, 1967: Fall Joint Computer Conference, Anaheim Convention Center, Anaheim, Calif.; contact AFIPS Headquarters, 211 E. 43rd St., New York, N. Y. 10017

May 21-23, 1968: Spring Joint Computer Conference, Sheraton Park/Shoreham Hotel, Washington, D. C.; contact AFIPS Headquarters, 211 E. 43rd St., New York, N. Y. 10017

Aug. 5-10, 1968: IFIP (International Federation for Information Processing) Congress 68, Edinburgh, Scotland; contact John Fowlers & Partners, Ltd., Grand Buildings, Trafalgar Square, London, W.C. 2., England

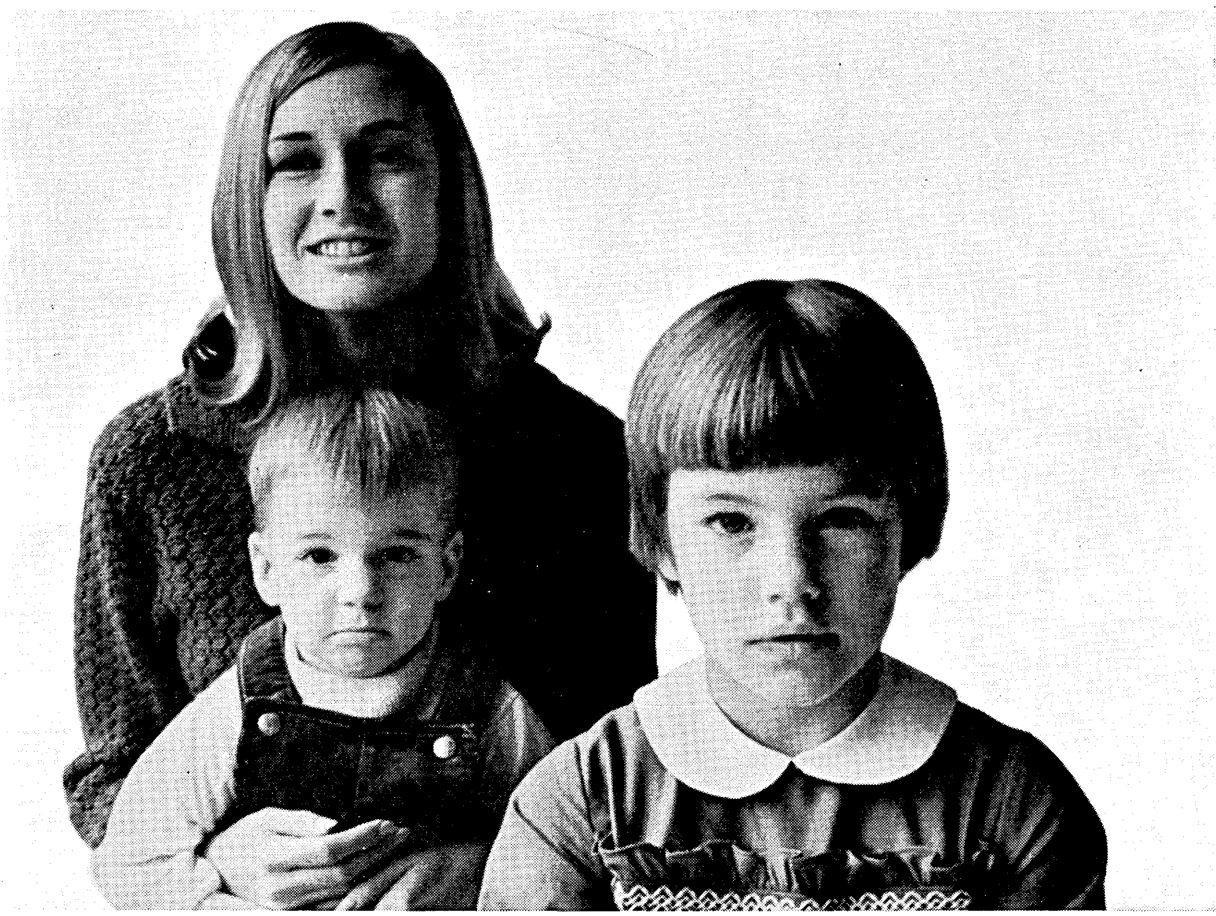
ADVERTISING INDEX

Following is the index of advertisements. Each item contains: Name and address of the advertiser / page number where the advertisement appears / name of agency if any

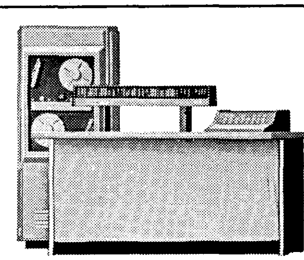
The NCR 315 family of computers.

(The second most important family for the man who wants to know everything about his business, everyday.)

The NCR 315 is no more one computer system than a family is one person. It's a family of computer systems. Related but tailored differently for the differing needs of every market group. One branch of our family is helping a west coast airline keep track of reservations. Another is helping a newspaper set type. Another series of 315 configurations is helping to meet the total data needs of industry (a Johnson's Wax installation is one recent example). A different branch of our family serves government. Another is automating window transactions for banks and savings and loan associations. And still another branch of the NCR 315 family is causing nothing short of a revolution in the retailing business today. We could go on until doomsday about the merits of 315 systems. Like RMC (rod memory computer) that cycles at billionths of a second. But that's another story (ask your NCR man). The thing is, whatever kind of data handling need you have, there's a member of the 315 family that can do the job.



NCR



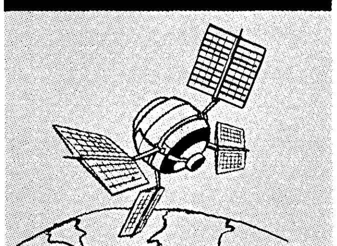
THE NATIONAL CASH REGISTER CO. ® DAYTON, OHIO 45409

Designate No. 15 on Readers Service Card

WHERE "NO-BREAK" OPERATION'S *A MUST*... THERE'S

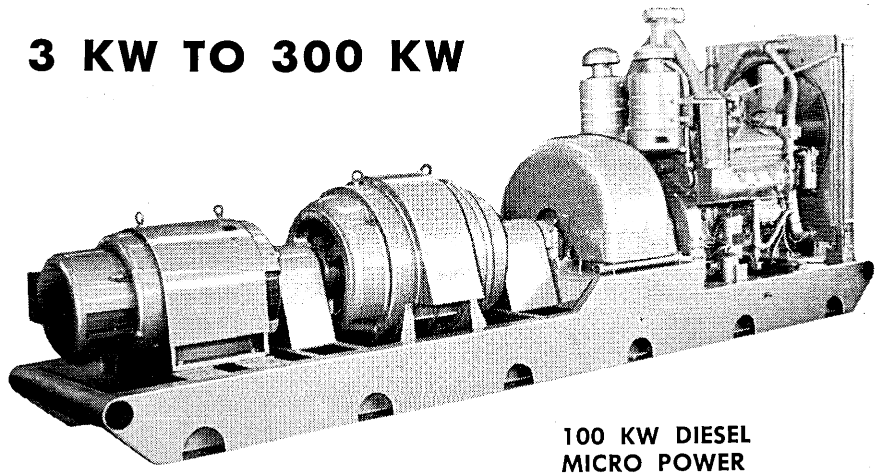
MICRO POWER®

microwave systems for communications

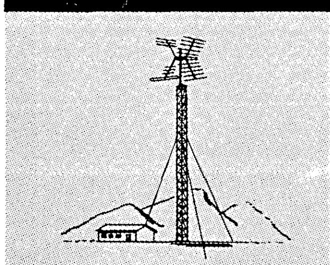


satellite tracking systems

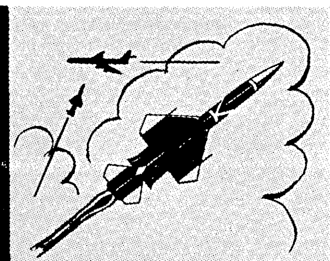
3 KW TO 300 KW



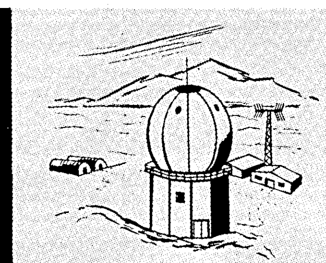
100 KW DIESEL MICRO POWER



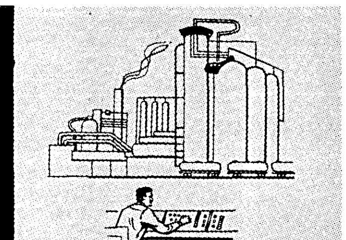
radio and television stations



rocket countdown and firing



early warning radar systems



refinery and chemical process control

MICRO POWER — a continuous duty, uninterrupted power plant for use with equipment that cannot tolerate *any* interruption of electrical power. Operating with the prime power source, it assures continued power supply in the event of complete, or partial power failure — and — eliminates the undesirable effects of voltage dips and peaks on equipment operating under normal conditions.

MAJOR FEATURES—

1. Separate motor-generator construction of Micro Power permits complete isolation of the load from the commercial power source. This allows power supply to the load that is absolutely free of transient disturbances, which would otherwise be conveyed by the commercial power supply.
2. Input and output voltage may be different, eliminating transformer requirements.
3. Micro Power provides off the line initial startup with automatic engine control.
4. Frequency drop during commercial power downtime is held to a minimum by Micro Power.
5. Brushless construction used in manufacture of motor, generator, and clutch reduces maintenance to a minimum.
6. Operating reliability is assured since bearings and shaft are oversized, and all operating components are conservatively rated. Unusually conservative rating of diesel engines results in fast recovery after engine startup.

UNITED STATES MOTORS CORPORATION · MICRO U.S. POWER · OSHKOSH · WISCONSIN

UNITED STATES MOTORS CORPORATION

339 West 20th Street • Phone 231-4560 (414)

OSHKOSH, WISCONSIN 54901